

# MONTHLY WEATHER REVIEW.

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The MONTHLY WEATHER REVIEW is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. L. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; H. H. Cousins, Chemist, in

charge of the Jamaica Weather Office; Señor Anastasio Alfaro, Director of the National Observatory, San José, Costa Rica; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belén College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian, which is exactly five hours behind Greenwich time, is used in the text of the MONTHLY WEATHER REVIEW.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea level and latitude 45°.

## SPECIAL ARTICLES, NOTES, AND EXTRACTS.

### STUDIES ON THE THERMODYNAMICS OF THE ATMOSPHERE.

By Prof. FRANK H. BIGELOW.

### VI.—THE WATERSPOUT SEEN OFF COTTAGE CITY, MASS., IN VINEYARD SOUND, ON AUGUST 19, 1896.<sup>1</sup>

#### THE SOURCES OF THE DATA USED IN THE DISCUSSION.

This waterspout has an especial scientific interest to meteorologists because it was seen under circumstances remarkably advantageous for making observations and photographs, from which it is possible to compute, with much accuracy, the dimensions of the tube, and thus facilitate the application of the mathematical theory of vortices.

A series of papers and letters from various persons who saw the phenomenon, and a very complete set of photographs, were secured at the time by the Editor, which he has courteously placed at my disposal for incorporation in this paper, and they will be found inserted in the following pages. I have myself been familiar with that part of the Massachusetts coast, and have therefore been interested to study the facts as thoroughly as possible as preliminary to the discussion of this type of vortex motion. I accordingly visited Cottage City the following September, and was conducted by Mr. Chamberlain to the spot where he placed his camera for making his photographs. There I made a sufficiently accurate survey of the linear distances between that spot and the telegraph poles shown in his pictures to determine the scale of distances for all objects. Furthermore, by collecting and collating all the data relative to the positions of the waterspout and the schooner seen in the several photographs, I am able to plot them on the Coast and Geodetic Survey Chart No. 112, in such a way as to reconcile nearly all of the statements made regarding the distances and progress of the two objects, respectively. The photographs taken from such distances as Vineyard Haven and Falmouth Heights give an excellent view of the whole cumulonimbus cloud from which the tube descended, and its connection with the thunderstorm which preceded it. All these data will enable us to discuss the subject of tornado and waterspout formation with considerable fulness, and with the conviction that confidence may be placed in the comparison of the observations and computations. There is every reason to believe that the photographs are perfectly genuine, and free from

touches to add to their artistic beauty at the expense of scientific accuracy. Certain preliminary computations were made in 1897, the result of which was published in the International Cloud Report, page 633, Report of the Chief of the Weather Bureau 1898-99, Volume II; this was republished in the MONTHLY WEATHER REVIEW.<sup>2</sup> My purpose then was to illustrate the application of certain formulae, and it was my intention at that time to complete the study as soon as my other duties permitted. In these present papers I shall begin with the descriptive accounts of the waterspout, then pass to a discussion of the facts as shown by these reports and the photographs, and finally consider the dynamic motions and the thermodynamic conditions present in the atmosphere near Cottage City on that occasion.

#### LETTERS AND REPORTS OF OBSERVERS.

The following letters, reports, and observations have been furnished by the several authors. It will be instructive to refer to fig. 25 while reading these papers.

#### (A) EXTRACT FROM THE DAILY JOURNAL OF U. S. WEATHER BUREAU STATION, VINEYARD HAVEN, MASS., W. W. NEIFERT, OBSERVER.

August 19, 1896.—Partly cloudy weather during the morning, with gentle northerly wind. Three magnificent waterspouts were observed in Vineyard Sound to-day, in northerly direction from station, about ten miles distant. During the entire afternoon the weather was partly cloudy and sultry, with great masses of cumulus clouds in the north and northeast. At 12:45 the first display was observed. At first a long spiral column seemed to fall from the clouds, about the thickness of a man's body, but this gradually increased in size as the cloud lowered, and when it reached the water it was as thick as a large sized cask, and changed in color from a rich gray to a black, and assumed a funnel shape at the base of the clouds. The cloud seemed of a yeasty white where the column came in contact with it, and looked as though the water was hauled up to it. The area of contact appeared small. The spout was very straight and almost perpendicular, kicking up a great sea as it traveled. When it disappeared it began to do so at the base and rapidly reached the top, having the appearance of clouds, and finally cleared away, like steam from an engine, at 12:58 p. m., leaving a clear sky for a background and the original clouds above. At 1 p. m. it formed the second time, which was really the most interesting spectacle of all. From a mass of inky clouds it reached down, finger-like, to almost the ocean's surface. Below it the water was stirred to an angry whirlpool, the foam reaching up perhaps a hundred feet. It appeared as though great volumes of water were traveling up to the cloud by an endless screw, when suddenly, at 1:18 p. m., the long arm disappeared in a manner similar to the first. At 1:20 it formed for a

<sup>1</sup> No. V of the series ("The Horizontal Convection in Cyclones") will follow later.

<sup>2</sup> May, 1902. Vol. XXX, pp. 257, 258.

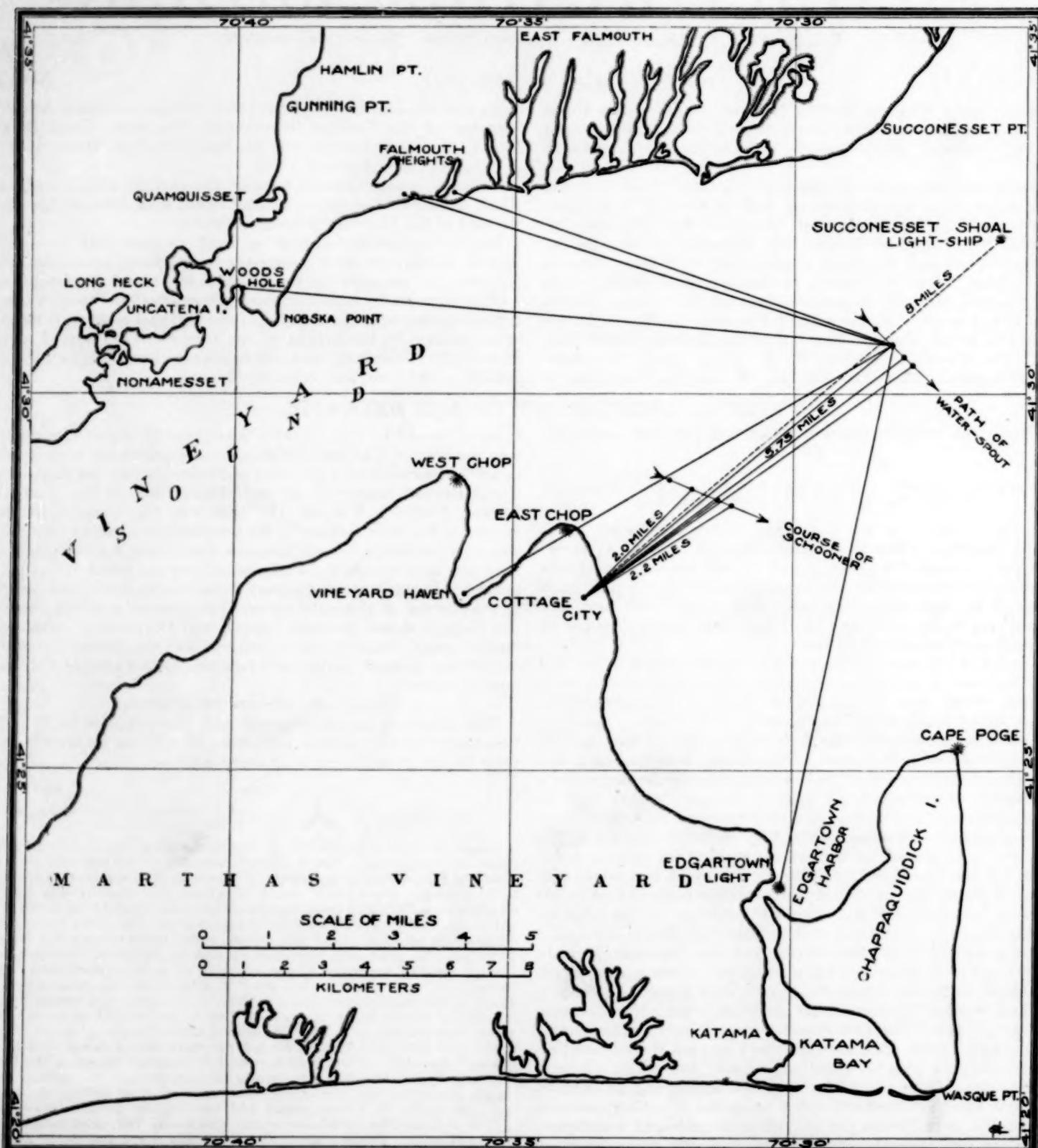


FIG. 25.—Location of waterspout seen in Vineyard Sound, August 19, 1896. (Reduced from United States Coast and Geodetic Survey chart No. 112.)

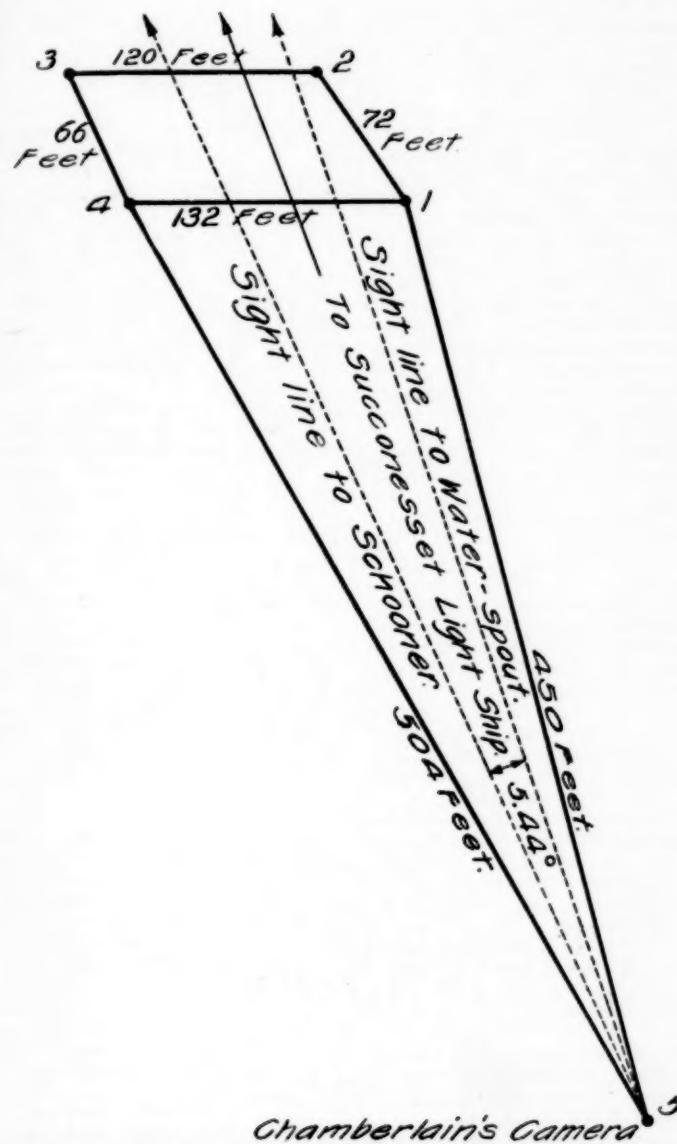


FIG. 26.—Diagram of the survey between site of Chamberlain's camera and four telegraph poles shown in his photograph, 2d A (fig. 27).

third time and scarcely reached the water, but had a decided funnel shape, lasting about five minutes, when it slowly withdrew into the blackness above and the surface of the ocean became quiet. There was a sprinkle of rain from 12:54 to 1 p. m., amounting to a trace. During the display the wind at the station was six miles per hour from the northwest; temperature 72°, with a fall to 56.5° during the thunderstorm which followed, passing over the station from northwest to south. Thunder was first heard at 1:45 p. m.; loudest at 3:04 p. m.; last at 3:45 p. m. Heavy downpour of rain from 3:04 to 3:15 p. m., then continued light rain until 3:30 p. m. Amount, 0.38 inch. The summer residents were stricken with fear at the approach of the dark clouds over the sound, and viewed the waterspout with mingled feelings of awe and interest. It was a sight long to be remembered, and when the weather cleared, about 4 p. m., each expressed himself as being most fortunate in having escaped some dreadful calamity. No noise was heard here, but the schooner-yacht *Avalon* of Boston was very near the spout and those on this vessel reported plainly hearing the noise and the wind blowing around the vortex with wonderful rapidity; to them the spout appeared to be one hundred feet in diameter. The three spouts moved gracefully to the eastward. This is the first display of this phenomenon witnessed here for 27 years. Mariners here who have circled the globe a number of times, and have seen dozens of waterspouts, declare it to be the most perfect specimen they ever observed.

(B) LETTER FROM MR. NEIFERT TO MR. A. J. HENRY. DATED VINEYARD HAVEN, MASS., DECEMBER 19, 1896.

When I first saw the waterspout it was in the vicinity of Black Buoy No. 13, on the east end of L'Hommedieu Shoal. Can not say now exactly, but in that general direction. Could just see base off East Chop. When the photographic view was taken here it was about where the red

dots surround sounding marked 8½. It appeared nearer then, but I presume this was caused by its base being hidden by the "highlands". The view from here was taken from on board of a yacht which lay at the red dot between the two wharfs or the head of the harbor under the figure 3 of the sounding marked 13.\* It may not be so far, but that is as I remembered it. There was so much confusion, women and children crying, that I was not very observant until it was over.

Coolidge was just north of the head of the wharf in Cottage City, and the "spout" was in an east-northeast direction from him. His views were made from the same position, and only time enough elapsed between them to change the plates.

(C) EXTRACT FROM THE DAILY JOURNAL OF THE U. S. WEATHER BUREAU STATION, NANTUCKET, MASS., MAX WAGNER, OBSERVER.

August 19, 1896.—Clear weather all day, except in the afternoon, when light rain began at 2:40 p. m. and ended at 4 p. m. Total amount 0.03 inch. Cooler, with rising barometer. Mr. Wagner went to Cottage City in the morning to check up; from there he observed the big waterspout that formed in Nantucket Sound. An ordinary thundershower was passing across the sound when, about 12:40 p. m., a huge black tongue shot down from an alto-cumulus cloud that floated a half mile high at the northern edge of the shower, and after rising and falling a number of times, finally joined a shorter tongue that seemed to leap out of the water to meet it. Twice the column parted for a moment, but joined again instantly. There was no apparent motion of the waterspout forward, and the phenomenon lasted for half an hour. It was pronounced by many sea captains who witnessed it the finest waterspout they had ever seen. No damage was done by the spout, but a small catboat which arrived at night reported being becalmed near the spout, the crew being badly scared.

(D) EXTRACT FROM THE DAILY JOURNAL, U. S. WEATHER BUREAU STATION, WOODS HOLE, MASS., J. D. BLAGDEN, OBSERVER.

August 19, 1896.—Three waterspouts were reported in the Vineyard Sound and one in Buzzards Bay between 12:35 and 2 p. m. One waterspout was photographed with excellent results.

(E) COPY OF A CIRCULAR ACCOMPANYING COPYRIGHT PHOTOGRAPHS. BY J. N. CHAMBERLAIN, OF COTTAGE CITY, MASS.

About 12:45 noon, August 19, 1896, we were startled by the cry of "A waterspout!" and with our assistants started with the camera to the park in front of Doctor Tucker's residence, where we could see, a little north of the direction of Nantucket, very dark and angry clouds, out of which a funnel-shaped cloud of various colors, with a pointed streak, issued downward until it touched the water. We obtained two photographs of this, showing a slight difference. [One of these views is reproduced as fig. 27.] After about twelve minutes it gradually and completely vanished. Very soon a second one appeared, more curved than the first, with a long sharp streak from the same clouds and slowly extending downwards to a point about one hundred feet from the surface of the ocean. In a few moments this changed to a smaller streak with a different curve bending to the south, while the former bent to the north. Both of these we photographed [figs. 34, 35]. The height of this, which Professor Dwight of Vassar College says was a genuine waterspout, was about a mile. The cloud-burst disturbed the water in the sound for several hundred yards until it looked like a boiling pool. We could trace through the camera the spiral motion of the water as it was drawn into the clouds, every moment augmenting their portentous darkness. The cloud from above and the spray from below were drawn together by suction, and condensed torrents of water poured down a few hours later, which was found by persons in different places on the island to be salt, and proves that it was carried up to a height and scattered round as solid bodies are by tornadoes on land. The Greeks applied the term "prester" to the waterspout, which signifies a fiery fluid, its appearance being generally accompanied with flashes of lightning and a sulphurous smell showing the activity of the electrical principle in the air.

(F) A REPORT TO THE EDITOR BY PROF. WM. B. DWIGHT, VASSAR COLLEGE, POUGHKEEPSIE, N. Y. DATED MARCH 22, 1897.

I now inclose such statements as I am able to make without the few memoranda, noted on the spot and since lost, of the waterspout of last summer at Cottage City.

The basis of my estimates of the height of the waterspout is rather hypothetical, but I submit them for what they may be worth. I have endeavored to assume my units of measurement so as to be *below* rather than *above* the fact, in order that the estimate might not seem to be made in a spirit of exaggeration. Thus, I am inclined to think that the distance of the schooner, in the photographs, from the shore is nearer three than four miles, which would make the spout higher than my estimate. One reason for my thinking so is that there is a buoy, the three-mile buoy, so called, not far from the position of the schooner and in front of her, about three miles from the shore and marking the channel. She was

\* On chart not reproduced.—EDITOR.

likely aiming for that buoy and then would not be very far from it. On the other hand, the state of the wind might lead her to go as much as half a mile or more outside (to the east) of it. I presume that the opinion of the seamen at Cottage City on the distance of the schooner could be easily obtained and would be of value. I think that I obtained such an opinion, but it is lost with my other memoranda and I can not now recall it. I have searched for the three-mile buoy in the photographs, but it is a very small object and I cannot identify it.

*Some statements as to the waterspout in Nantucket Sound (sometimes called Vineyard Sound) easterly from Cottage City, Martha's Vineyard, Mass., at noon of August 19, 1896, made from personal observations by William B. Dwight, of Vassar College, Poughkeepsie, N. Y. (resident in the summer at Cottage City).*

My summer cottage is situated close to the beach at Cottage City, with unobstructed view of the ocean. I was standing upon my private wharf, nearly in front of the cottage, when the waterspout of August 19, 1896, began; I saw it at the outset and was among the first to call general attention to it in our part of the town. I watched it closely, with the assistance of a good field-glass till the close of the phenomenon, but I had no proper instrument at my command for taking the altitude.

Excellent photographs were taken by Mr. Coolidge and Mr. Chamberlain. I am able to testify to their general correctness as corresponding with personal observation. Mr. Coolidge's are most artistic views of the whole scene and scenery. Three of Mr. Chamberlain's present with accuracy three consecutive views of the waterspout in its phases, changes, and progress taken from one and the same spot. They were taken with total disregard of the foreground and the sole aim of getting the best views of the spout itself. These facts give these three views a marked scientific value, and these photographs will repay a careful scientific study.

Like all of the three phenomena of this kind which I have personally observed (and this is the second which I have seen from Cottage City), the funnel of the tornado is constantly changing its form, length, and other dimensions; and occasionally, or at intervals, it may entirely disappear in its cloud, only to reappear again in full force. This one had several such successive appearances with intervals of total disappearance. Hence the photographer, the newspapers, and the spectators generally described the appearance of several waterspouts on this occasion. I consider this an unscientific and unfortunate mode of describing this phenomenon, chiefly for these two reasons.

1. There was only one great but entirely distinct and individual cloud concerned in the phenomenon from beginning to end, and in fact only one particular spot in that cloud. This not only follows from my own observation but is demonstrable from a study of Chamberlain's three photographs, as I propose later to show. This cloud and its point of vortex movement sustained constantly throughout the waterspout phenomenon, three quarters of an hour (or more), the same relation to the furious squall of lightning, thunder, rain, and hail, going on about a mile to the southeast of the waterspout, i. e., a mile from the thunderstorm to the edge of the waterspout. This squall is clearly visible in Chamberlain's first photograph of the three mentioned.

2. From the point mentioned in the tornado cloud, (as I will designate it in distinction from the squall cloud), a waterspout funnel would descend to the ocean, and move along its surface in an easterly direction, with its cloud; after a while it would thin out, or break into pieces, and nearly or quite disappear. For the most part, however, the location of its minimized force in the cloud remained marked clearly by a downward bulging of that part of the cloud, with indications often of rotary movement at the spot. Once, however, the spot where this tendency to vortex motion still existed was for a few minutes lost to view; but soon the vortex movement visibly returned somewhere along the line between the cloud and the ocean, from the point of the cloud which was affected. It generally appeared first at the cloud, but once the vortex movement at the ocean's surface was practically simultaneous with that at the cloud; then another column or spout was completely formed, but as the cloud had been moving eastward during the interval, the spout would of course be seen in a position somewhat to the eastward of its former place; and so this disappearance and reappearance was several times repeated. Those of the more intelligent observers who insist that there were "several waterspouts" on this occasion base their statement on these two arguments: (1), that there were successive spouts seen; (2), that no two of the spouts were in the same place.

On the contrary, I hold that my preceding remarks, and the further facts to which I shall call attention later, show that this was the same phenomenon, that is, the same center of vortex action, throughout, and that its different appearances were not different waterspouts, but simply different and varying phases of one and the same phenomenon. As to the second point, the difference in position, I contend that the differences in position were only those which a waterspout drawing itself up into its cloud, and then coming down again, must necessarily take in consequence of the constant southeastward progress of the storm. It could not come down in the same place any more than a circus rider can when he leaps up from the back of a running horse and comes down again several feet ahead of his former position. The successive phases of this waterspout, in their positions, follow strictly the eastward movement of the tornado cloud, and inspection of the three photographs of

Chamberlain's set shows that a line between the first and last phase of his three would pass through the position of the intervening one.

This may seem a matter of little consequence in terminology; but it is of importance in view of the fact that the expressions "two waterspouts", "several waterspouts", etc., are positively needed for cases where two or more entirely independent phenomena of the kind are in sight at the same time, or nearly so; as when a friend of mine once saw eleven waterspouts on the ocean simultaneously.

I will now give a brief description of the successive phases of the waterspout as I observed it.

I was standing on my own private boat wharf, which is on the sea-shore at the extreme southeast point of Cottage City, one-half mile exactly south of the "Oak Bluffs" or main wharf, the wharf shown in Coolidge's photograph, No. 7933, fig. 28, a little after half-past twelve. In the excitement of the occurrence I failed to note the exact time. An exclamation from a friend standing near me drew my attention to the waterspout, which had just formed in the rear of a black thundersquall which we had been watching to the southeast, the wind being from the northwest. The waterspout being a mile or more in the rear of the squall and separated from it by a clear interval, was a little north of east from my position of observation; it appeared to be somewhat nearer than the Succonesset light-ship (on Succonesset Shoals), which is nine (9) miles easterly from Cottage City; at the same time it was evidently nearly as far. I had several interviews subsequently with captains of the local fishing catboats, all men of lifelong experience as coasters, with reference to the probable distance of the spout. They all estimated it as from eight to ten miles away; no one gave a less estimate than eight miles. All but one of the captains had seen it only from Cottage City. One captain, however, told me that he was sailing to Cottage City from Cape Poge, a point seven miles to the southeast of Cottage City, and saw the waterspout when he was off that cape, and that it was certainly nearer to Cottage City than the Succonesset light-ship (which from his position would be much in the same direction); he said it was, in his judgment, about one mile nearer to Cottage City than the light-ship; this is excellent testimony on this point, and I think we may safely set the distance of the waterspout from the Cottage City wharf as having been just about eight miles.

At this first phase the waterspout was very tall and very thin; in fact it presented very much the same appearance as in No. 3 of Chamberlain's set, fig. 35, though in a much more northwesterly position; at its base was a spherical mound of up-whirling water and spray several times wider than the main portion of the column, a white dot of foaming water appearing at the center of this mound at the ocean's surface; the column was sinuous and moderately expanded as it joined the cloud. The tornado cloud had a broad, flat, angry looking under surface, little tufts of mist or rain descending from it here and there; it extended at least a mile to the east and southeast, joining the thundersquall in the latter course. Toward the north and west it was much less extensive, and in fact more than one-half of the sky over Cottage City was in bright sunlight. At times it appeared as if streaks of rain were descending from the tornado cloud to the ocean all around the waterspout in all its successive phases.

This *first phase is not shown in any* of the professional photographs, though probably some amateur's camera may have caught it. Comparatively few persons saw it, that is only those who happened to be at the beach; the morning bathing hour was mostly over; the professional photographers were in their offices inland; it took time to get word to them and for them to bring out their instruments and get them placed in good positions. Meanwhile, this first phase faded away, and that one of the views of the photographers which is generally called the "first waterspout" is not at all the first, but the *second* phase, and a much larger and grander one. The second phase, which appeared at about a quarter to one o'clock, was by far the grandest one of all. It is the "first" one of the photographers, the one shown by Mr. Coolidge's photograph numbered 7933, fig. 28. It began by the formation of a broad funnel on the under side of the tornado cloud, which then became a very broad black tube. This rapidly stretched down to the ocean, where it raised a large mound of whirling, foaming, rising water at the center, and of spray around its margin. The white center of upward rushing water was usually clearly visible to the naked eye, and through a field glass was very marked. At other times it was completely obscured by the surrounding mist and spray, and was never relatively large to the view, because so thoroughly enveloped. \* \* \* There was no white water visible at any time in the tube proper, above the mound. This phase lasted probably about fifteen minutes, during which it varied in form from a slender, even cylinder, to a massive, imposing conical tube, as it swept on slowly and majestically to the southeast.

From this phase we are enabled, through Mr. Chamberlain's valuable set of photographs, to trace the forward progress of the tornado cloud visibly, and the relations of this and the succeeding phase to each other, since these three views were taken by the same camera and lens, and from exactly the same point. (I have established this point, as it is easy for any one to do, on the spot, by taking a position on the west margin of the main portion of the Ocean Park adjoining the Oak Bluffs dock, where the relative positions of the telegraph poles, and their several arms and wires can be made to coincide exactly with their relative posi-

tions in the photographs. It will be noted that these positions are exactly the same in the three views, though in the last one the camera was revolved more to the southeast than in the others. This point of observation proves to have been at the center of the convex western edge of the main body of the park, just east of the carriage road which extends in a curve from one point of the Sea View avenue to another point of the same avenue around the west edge of this main portion of the park. It is called Ocean avenue. The point where the camera stood is just east of Ocean avenue, where a straight line running through the east end of Fisk avenue would strike it.)

Now, in examining Chamberlain's first view, fig. 27, where the grandest phase is seen, the waterspout is shown a little north of the two central telegraph posts of the view, while a schooner is seen sailing southeast about three or four miles from the shore, some little distance to the north of the waterspout. Also, a little northerly of the waterspout, about a third of the apparent distance (in the view) between it and the schooner, the masts of a vessel at anchor appear on the horizon. This is apparently the Succosset light-ship, nine miles away. It is certainly about the position of that light-ship, and resembles closely its familiar appearance, as seen from Cottage City. This would seem to locate exactly the direction of this phase of the phenomenon from Cottage City. As my charts of Nantucket Sound (or Vineyard Sound) are at Cottage City, and my notes made on the spot are lost, I can not at this time state the bearing of the light-ship from the point mentioned as the position of Chamberlain's camera; but it can easily be settled by reference to such a chart.

Mr. Coolidge's photograph No. 7934, fig. 32, seems to show a later form of this phase, the column having grown thicker and more evenly conical since Chamberlain's first and earlier view was taken. This appears from the fact that the schooner is now much nearer to the line of direction of the waterspout, in which direction she was sailing faster, apparently, than the spout was moving in the same direction. It is true that Coolidge's standpoint was evidently to the north of Chamberlain's, being near the steamboat dock, and quite near the shore, while Chamberlain's position was about five hundred feet from the shore. But when all allowances for difference in position have been made, there seems to be still quite a margin which can only be explained by the fact that the vessel had actually had time to sail some distance southeasterly.

When this grandest phase disappeared the spout was for a few minutes totally absorbed into the cloud. Then, while I was closely watching it for further developments, a whirling funnel began to bulge down from the tornado cloud, while at the same moment, and before the funnel was more than a mere projecting knob on the cloud, the water on the surface of the sound just beneath began to boil furiously, and to rise up in a whirling mound, indicating a line of vortex motion already established the entire distance between the cloud and the sea. Next, while the upper tube began to extend downward, a central portion of the tube was formed, entirely independent of the upper and lower portions, as clear spaces existed between.

This is finely shown in Chamberlain's second photograph, fig. 34, where the three portions are distinctly seen before their union. Many persons on seeing his three views take the one which shows the waterspout as a very slim tortuous tube, fig. 35, as the first exhibition of a waterspout, of which the one in three portions is but the breaking up phase. That this is not the case is indicated by my own most positive observation of the triple formation of the spout, to which I called the attention of bystanders at the time. But, further, the photographs themselves prove the incorrectness of that idea; for it will be noted that in the view of the spout having the triple structure, fig. 34, the column has just passed from its second phase, where it appeared a little to the north of the pair of central telegraph posts, to a position a little to the south of the more northerly of these posts, while the schooner has passed to a central position between them. In the other view, fig. 35, the column has come near to the more southerly of the posts, while the schooner has passed considerably to the south of both, and has been closely approached by a tug towing three barges, which was only just coming into view in the other photograph.

I need only to remark further, therefore, in this connection, that the third of Chamberlain's set of photographs, fig. 35, represents the completed form of the waterspout shown in the second view, and the third and last actual phase of the entire phenomenon. As this phase disappeared at about 1:25 p. m., the entire occurrence covered a little over three-quarters of an hour.

If one were disposed to form some estimate of the rate of progress of the waterspout, from that of the schooner, the following points would deserve consideration:

1. Though the wind was violent in the vicinity of the squall, there was but a moderate wind on the shore and in the vicinity of the schooner. This is not a matter of my recollection alone, for the photographs show it; the sea near the shore is little disturbed, while the schooner carries all sail except topsails, and has no reefs. If we may estimate the probable length of her hull as 75 feet (a moderate estimate), she must have gone somewhat over half a mile during three-quarters of an hour. Her course being somewhat oblique to the line of vision, and veering away from the observer, is really longer than it measures on the photograph. The tide runs with great force, and may have worked against the schooner.

2. The waterspout was certainly twice as far away as the schooner. Supposing, as is very likely from evidence elsewhere offered, that it was just about twice as far, and moving, as appears to have been the case, in the same course, the tornado cloud and the waterspout must have progressed considerably less than twice as fast as the schooner, since the latter, starting from a spot considerably to the north of the spout passed to the south of it.

Toward the close of this phenomenon the eastern half of the sky became quite black with clouds, while the entire western half, where the Cottage City observers were, was brilliant with sunlight, which at this hour glanced easterly beneath the blackness. The chromatic effects were of an indescribably rare and beautiful kind. The surface of the sound for several miles out was lighted up with weird hues of bright blue, green, yellow, and gray, in patches, according to the nature of the variable weedy and sandy bottom, greatly intensified by the solemn, black storm clouds and waterspout overhead. Thousands of spectators, crowding the beach, gazed on the sight with mingled admiration and awe.

I append some estimates of the probable dimensions of the waterspout founded on its apparent distance, as ascertained by investigation, and upon measurements of the photographs, using as a unit the hull of the schooner in view, estimated as 75 feet long and four miles from shore. I am inclined to think that the schooner's distance was nearer three than four miles, and that the estimates should be increased proportionally. By my estimate the waterspout would have an altitude of about half a mile.

The conditions of the photographs of Chamberlain's series might afford another basis for an estimate.

By ascertaining the distance from the spot where the camera stood to the higher one of the central pair of telegraph posts (as the other stands on lower ground), which distance is not far from 500 feet, and the height of the telegraph post, and assuming the probable distance of the waterspout as eight miles, triangles could be constructed from which the height might be calculated, provided that the telegraph posts were not so near to the camera as to be disproportionately magnified. I suppose corrections might be applied for such irregularity if the power of the lens were known.

*Rough estimates as to dimensions of the waterspout seen from Cottage City, Mass., August 19, 1896.*

(1) Estimates founded on photograph No. 7934, fig. 32, taken by Coolidge, and based on the supposition that the waterspout was eight miles from Cottage City, and that the schooner visible to the north of it is 75 feet long and four miles from Cottage City. In this photograph, the schooner's hull (not including the bowsprit), estimated at 75 feet, measures one-tenth inch. The waterspout being twice as far distant should therefore measure 150 feet for every one-tenth inch of dimension. Some correction should be made, in strict calculation, for the tendency of the camera to magnify near objects more than distant ones; but this is comparatively slight for two objects both of which are distant, and may be disregarded in a rough estimate.

Using this unit of measurement, 1-10 inch on the photograph corresponds to 75 feet at the schooner, or 150 feet at the spout:

	Feet.
Height from surface of ocean to lower edge of cloud (= 1.917 inches).....	2874
Mound of spray at base of the spout:	
Height .....	600
Breadth .....	750
Breadth of the mass of foaming water in this mound .....	150
Tube or funnel proper, above the base mound:	
Breadth (diameter) just above the mound .....	150
Breadth about the middle .....	300
Breadth at extreme top where it joins the cloud .....	600

(2) Estimates founded on a photograph by Chamberlain, fig. 27, and called by him the "first" waterspout. It shows the spout of larger size and grander appearance than the later views. These estimates are based on the assumed length of the schooner in sight, and its distance, assisted by known facts as to the position of the ship channel, and on the supposed distance of the waterspout, judging from reports of captains of fishing boats who got its range. This is really the second and not the first stage or appearance of the spout, as witnessed by myself from its very beginning.

In this photograph the hull of the schooner (75 feet) measures 13-10 of an inch. Its estimated and probable distance is not over four miles, that of the waterspout eight miles. Hence the unit of measurement, 13-10 inch, would cover 150 feet at the waterspout. The dimensions would then be as follows:

	Feet.
Height from ocean to cloud .....	2600
Height of basal mound of spray .....	300
Width (diameter) of basal mound of spray .....	600
Tube proper:	
Width at lowest point .....	150
Width at middle point .....	100
Width at top .....	375

*Remarks.*—This photograph represents, as I can testify from personal

observation, the same spout, or phase of the spout, as Coolidge's No. 7934; but at a different minute of its existence, since the form is considerably different. The spout was changing constantly in length and width within certain limits, but was throughout the largest of the phases. The difference in the apparent length of the schooner's hull from that in Coolidge's photograph is due probably to a stronger lens.

(G) LETTER OF E. B. HANES, TO THE EDITOR. DATED COTTAGE CITY, MASS., OCTOBER 26, 1896.

Your letter of October 20 is at hand. I am sorry to say that I do not know of any scientific observations of the waterspout seen in Vineyard Sound, August 19. I had an excellent view of it throughout its entire duration, a portion of the time through a six-inch astronomical telescope. It occurred August 19, 1896, at about 1 o'clock p.m. It had been a calm summer day, with but few clouds, temperature about  $70^{\circ}$ , with but little variation before and after the phenomenon. It has been stated that there were two or three waterspouts; this, I think, is hardly correct, as no one saw more than one at the same time, the so-called different ones being different forms or *reformations* of the same spout. Its beginning was, from my point of view at Cottage City, about six miles distant, in a line toward Cutout; its ending, about eight miles, in a line toward Hyannis. It had a steady progressive movement and was inclined forward in the direction of advance. I estimate its forward movement at about eight miles in the thirty-five minutes it continued. During the time of the waterspout, showers, with lightning, could be seen preceding and following it in its course; about an hour afterward Cottage City was visited by a tempestuous downpour of rain. Through my telescope the column seemed to be surrounded by a dense vapor, which radiated like smoke from its edges, and, condensing, fell in torrents of rain for a distance in either direction about equal to the diameter of the column. At first the edges of the column were quite well defined, later it grew much larger in diameter and more diffuse, its height remaining the same throughout. While I could not penetrate with my telescope the enveloping mist so as to see if there was a solid or tubular mass of water either ascending or descending the inner part of the spout, nor detect a whirling or spiral movement, yet the funnel shape at the top and general appearance indicated that character. Based upon estimates of the most careful observers, its probable size was from 100 to 300 feet in diameter at different periods, and 4000 to 5000 feet high. Where the column joined the sea there was a great churning and splashing of the water, which extended as white mist for 200, or more, feet upward and outward; this was more pronounced toward the last. When the spout finally disappeared it grew slender and broke about midway of its height, the lower portion dropping into the sea and the upper dissipating into the cloud.

(H) EXTRACT FROM THE REPORT OF THE CLIMATE AND CROP SERVICE, NEW ENGLAND SECTION, AUGUST, 1896, BY J. WARREN SMITH, SECTION DIRECTOR.

On August 19 three well-defined and magnificent waterspouts were observed in Vineyard Sound, between the eastern edge of Marthas Vineyard and the mainland, about off Succonesset Shoal.

Mr. W. W. Neifert, the Weather Bureau observer at Vineyard Haven, writes: "During the entire forenoon the weather was partly cloudy and sultry, with great masses of cumulus clouds in the north and northeast". [The remainder of this quotation is practically identical with (A) above.—EDITOR.]

We have reports of the phenomenon from Mr. E. H. Garrett, who observed it from the coast between Hyannis and Oysterville; from John B. Garrett, who saw it from Falmouth Heights, and from Dr. S. W. Abbott, Secretary of the State Board of Health, who was in West Falmouth Harbor at the time.

Mr. E. H. Garrett says: "We were out on the beach and saw an odd looking cloud in the sky. It seemed to have a curious appendage at first, which one of the party described as looking like 'an icicle.' We turned to go home, when one of the group looking back saw the 'icicle' changing, and we all watched. It grew larger, then looked like a long, thin, gray veil of mist and as it descended the water from the Sound began to rise. I watched it carefully and should say it was over 300 and nearer 500 feet high, and in comparison with the measurement of schooners lying near it, it certainly could not have been less than 125 feet in diameter".

Mr. John B. Garrett saw it from Falmouth Heights in an east-southeast direction, and its distance was estimated to be from six to ten miles. He says: "In form it was much like a short section of rubber pipe, flexible, and of the color of a heavy watery cloud. It was telescopic, the upper end of the column vanishing in the small end of a funnel-shaped cloud somewhat larger than itself.

"Shortly before it broke and disappeared, the main column drew upward, disclosing at its lower end a smaller column or tube within the main one. There was also visible for a time, as it broke, a distinct spiral and rotary motion, extending about one-third the length of the column from its upper end.

"During the whole appearance the water at its base, considerably wider than the column, was churned into a seething mass and raised to a great height.

"If the estimate of the distance from Falmouth Heights be approximately correct, your previous correspondent's estimate of the diameter

of the waterspout, 125 feet, must be within rather than beyond the actual; and, assuming this as correct, the height of the column can not have been less than 750 feet. The height to which the spray was thrown was decidedly greater than the width of the column, and must, therefore, be estimated above 125 feet".

Doctor Abbott estimates the height of the waterspout to have been 3000 or 4000 feet, judging from its appearance above a distant hill, and the "probable distance away of the phenomenon". He says: "From all that I can learn, the waterspout was about 25 miles distant". But it could not have been that distance away from him, and yet have been seen in an "east-southeast" direction from Falmouth Heights, and in a "northerly" direction from Vineyard Haven. Still from his point of view, at ten miles distance, it must have been over 1000 feet in height. He writes that "the waterspout was soon followed by marked atmospheric disturbances. Thunder, lightning, hail, and rain in abundance fell within an hour or more. A dense, dark cloud formed in the northwest, followed by a squall from the southwest, and the wind shifted in a short time from northeast to southeast, and then by southwest to northwest. The thermometer at 2:00 p.m. indicated  $56^{\circ}$ , a very low reading for a place where it has varied but little from  $70^{\circ}$  all summer".

(I) COPY OF LETTER OF REV. CRANDALL J. NORTH, OF NEW HAVEN, CONN., IN THE CHRISTIAN ADVOCATE FOR SEPTEMBER 24, 1896.

Thousands of summer residents of Marthas Vineyard, Nantucket, and the adjacent Massachusetts coast were treated to a spectacle of remarkable grandeur one day in August, last. Guests at the hotels and occupants of cottages at the various resorts were just rising from dinner when the cry was raised, "A waterspout, a waterspout!" The scene presented to view was such as not one in a thousand had ever witnessed before or would ever see again.

A large mass of heavy black cloud hung high above the ocean between Nantucket and Cape Cod. Suddenly it was seen to project a circular column of its own dense vapor perpendicularly downward, rapidly but not precipitantly, until sea and cloud were connected by a cylinder one or two hundred feet in diameter, straight as a pine tree, and at least a mile high. It was a waterspout indeed, of most unusual proportions and indescribable beauty.

The sea was perfectly calm, the air almost motionless, the sun shining brightly, light summer clouds hanging here and there over the deep blue sky; and in strange contrast with all the rest, was this lofty mass of black vapor with its absolutely perpendicular support. To add to the weird effect occasional livid streaks of forked lightning shot athwart the black monster cloud above. The column was only slightly funnel-shaped just where it joined the cloud, and was of equal diameter the remainder of its length. At its base the sea was lashed into a mass of white foam and spray that mounted upward as high as the masts of a large schooner.

From Cottage City it seemed about six miles distant, but careful observation through a glass from the writer's view-point showed that it was nearly in line with the light-ship off Hyannis Harbor, and still farther distant, its foot resting upon the sea beyond the horizon line. It must have been twenty or twenty-five miles away, but such was its magnitude that it seemed not more than one quarter of that distance.

It moved slowly eastward, and continued with little change in form for seventeen minutes. Then it gradually attenuated till it looked like a dark ribbon hanging out of the cloud, and at length disappeared. The lashing of the water into foam and spray where its base had rested continued unabated, which was evidence that the waterspout was still there, though now invisible, and that it might be expected to reappear. Surely enough, after an interval of about ten minutes, the cylindrical form of black vapor began to push its way downward again from the cloud and continued until it stood again upon the white mass of foam and spray mounting up from the sea surface. This time its top was more funnel-shaped and curved to the eastward. It continued eight minutes and disappeared. The projecting of the visible vapor downward caused the illusion that its origin was from the cloud rather than from the sea, and many supposed that it was a cloud-burst rather than a waterspout; but this is disproved by the continuance of the agitation of the sea surface during the interval between the disappearance of the first column of visible vapor and the formation of the second. Also the descent of the column was too slow for a mass of water falling from a cloud-burst, as was clearly apparent a little later, when a real cloud-burst occurred upon the mainland opposite, in full view from our point of observation.

The apparent formation from top downward was due to the fact that the atmosphere became more rarefied by the swifter gyrations of the whirlwind at the higher altitude, causing the invisible vapor carried up from the sea surface to condense and become visible at the highest level first; then its visibility gradually extended downward as the velocity of the gyrations below increased. The whirlwind lashed the sea into foam and spray and vapor, and stood it up in an invisible column; but it turned into cloud at the top first, then downward its entire length, until there it stood for many minutes before the wondering gaze of thousands, a veritable "pillar of cloud by day".

The old sea captains of Marthas Vineyard said that this waterspout exceeded in size and grandeur anything of the kind they had seen during all of their seafaring experience. Enterprising photographers secured several good photographs of the remarkable phenomenon.

(J) COPY OF DESCRIPTION BY DR. F. C. V. H. VON SAAL; APPARENTLY COMPILED FROM OBSERVATIONS AT COTTAGE CITY, AND PUBLISHED IN THE SCIENTIFIC AMERICAN, NEW YORK, SEPTEMBER 26, 1896.

About 12:30 p. m., August 19, 1896, one of the very dark clouds hovering over Vineyard Sound, between the mainland and Cottage City, was seen to send out a downward and sharply pointed streak of cloud matter, whose funnel-shaped basis above was not at all times visible. After a duration of about fifteen minutes it broke and completely vanished. The apparition quickly emptied of their summer residents all the cottages along the Sound and adjacent islands, Nantucket included. No photographs were taken of this first spout, to my knowledge.

Shortly afterward a long tongue emanated from the same clouds, and was slowly pushed downward to a point about 100 feet from the surface of the ocean. Its height was certainly a mile, and the band-like shape gradually increased in width. With a glass, slow gyratory movements could be detected, also longitudinal stripes caused by falling water. This cloud-burst<sup>4</sup> made the water below, over a surface of many hundred yards, look like a boiling pool. The jumping spray from this was also caught and drawn upward into the whirl toward the downpouring column. This latter, now of lighter color, being struck by the sun, was gradually withdrawn upward, evidently thinning and broadening toward its base. With a glass, mists could still be seen falling into the snow-white foaming area below. The duration of this second and most perfect phenomenon of the day—there were three in all—was about half an hour.

About twenty minutes after its disappearance a third began to form, gradually coming downward from the same clouds, though from a spot a little farther north; but it hardly reached completion. It is very important to note that, in this third case, the ocean below was entirely quiet for a time, being only disturbed later on, when the same process of condensation, mentioned above, caused a similar downpouring, especially noticeable in the period of retraction. It was soon apparent that the agency causing the spouts had spent its energy; the column was evidently thinner in substance and its formation slower and hesitating. It stopped midway, sending only an attenuated end farther, to be withdrawn upward soon after.

During almost all of the time since the appearance of the first spout there was a heavy rainstorm accompanied by flashes of lightning from the northern and darkest portion of the long motionless stratum of clouds above mentioned.

Cottage City, which had been in sunshine until then, was visited by a drenching rain some hours later.

The long duration of the phenomena just described enabled the writer to form a somewhat different opinion of the nature of such waterspouts from what is commonly held. True, I must fall back upon the old (or rather older) explanation, that such whirls are caused by two winds striking each other at an obtuse angle. The greatest rotary velocity must be placed at the spot, about 100 feet above the ocean, toward which the cloud matter from above and the spray from below were drawn. As condensation was continually transforming this cloud matter into water, it stands to reason that by far greater quantities of it were drawn down than was apparent to the eye.

But the spout is from above and not from below, as a glance at the cut conclusively proves. This also definitely settles the question as to what part the ocean takes in the constitution of the column, which is practically none. The "boiling as if in a caldron" is not caused by the action of the circling wind, but by the great quantities of falling water. Nor is there a whirlpool action in, nor rising from, the body proper of the ocean. The way the spray, caught and drawn up, looked at times, easily explained to me how this delusion originated.

The surprising tranquility of the clouds shows that such currents of wind need not be of great height, at least not at their borders, where alone such whirls can take place. That the spouts scarcely shifted their position is proof that the velocity of the concurrent winds was almost equal. It is certain that this velocity can not have been great. Several small vessels in close proximity at the time report that there were a great noise and gusts of wind in the immediate vicinity of the display, while beyond this there was almost a dead calm (Boston Globe, September 1). This latter statement, however, seems to be somewhat exaggerated.

#### THE PHOTOGRAPHS.

We have to acknowledge our debt to the photographers who happened to be in the neighborhood of Cottage City on August 19, 1896, for an admirable series of pictures which cover the most important features of the phenomenon. Messrs. Baldwin Coolidge, 146 Tremont street, Boston, Mass.; J. N. Chamberlain, Cottage City; F. W. Ward, 16 Adams street, Burlington, Vt.; Dodge, of Bangor, Me.; and E. K. Hallet, through Mr. Coolidge have placed their photographs in the care of the Weather Bureau for study, and our thanks are hereby extended to these gentlemen for their courteous contributions

<sup>4</sup>Of course this was not the "cloud-burst" of technical meteorology, for that is simply an unusual excessive rainfall.—EDITOR.

to the available scientific data that have come into our possession. Both Coolidge and Chamberlain were stationed on the bluff at Cottage City, and had a clear view over the ocean to the waterspout; Mr. Ward stood near the foot of Hope avenue, in Falmouth Heights; Mr. Dodge was at the head of Vineyard Haven Harbor and saw the spout across the headland near East Chop light; Mr. Hallet was on the high ground west of Cottage City. These locations are shown on the chart, fig. 25. Some other photographs were taken on a small scale which contributed somewhat to the information contained in those reproduced in this memoir.

The first appearance of a waterspout began at 12:45 p. m. and ended at 12:58 p. m.; no photographs were made of this phenomenon, as it required time to bring the cameras into operation. Mr. Coolidge was half a mile away from his studio, at home for dinner, when this spout appeared; he started to secure his instrument, when unfortunately the spout disappeared. He was ready on the bluff for the second appearance, which began at 1:00 p. m. and ended at 1:18 p. m. He used a rapid symmetrical Ross lens, with a focal length 14 $\frac{5}{8}$  inches from the diaphragm to the ground glass, or 13 $\frac{1}{2}$  inches from the back of the lens to the ground glass. Mr. Chamberlain brought his camera from his studio to the edge of the park, about 200 yards from the water, and his pictures, therefore, include a foreground showing several telegraph poles. The measured distances between these objects give the scale of the photograph, which becomes more valuable on this account. He used a large camera, No. 5 euroscope, with equivalent focus of 17 $\frac{1}{2}$  inches from the optical center to the sensitive plate, and a lens of 3 $\frac{1}{8}$  inches diameter. These sets of photographs by Coolidge and Chamberlain both show a schooner which was sailing southeastward, and the positions of the schooner relative to the waterspout in its successive positions are very useful in determining the time intervals between the successive pictures. One of Chamberlain's, fig. 27, also shows the Succonesset Shoal light-ship, together with the waterspout near it, and this is important in identifying the direction of the sight lines from Cottage City. Mr. Ward's picture was taken with an Anthony kodak triad camera, 4 $\frac{1}{2}$  inches focal length, and the plate is 4 by 5 inches; this was enlarged by Coolidge to the 8 by 10 size. It shows the cloud formation and is most instructive as to general meteorological conditions; it also shows the curvature of the vortex tube at right angles to the view from Cottage City, where it seemed nearly straight, as seen in perspective during the second appearance. Mr. Dodge caught a distant view of the spout, and his picture also shows the great cumulo-nimbus cloud from which it descended; his sight line passed just to the south of the East Chop light-house, and this distinctly identifies the direction of the spout at that time. Hallet's picture was taken with a small camera, but shows the large cumulo-nimbus cloud so well that I have taken it as the basis of the thermodynamic computations.

The following is a list of the photographs and the times when they were taken:

#### SECOND APPEARANCE.

Fig. No.	Serial No. of photograph.	Phase.	Photographer.	Moment of exposure.	Photographer's numeration of negative.
27	1	2d A	Chamberlain.....	1:02 p. m.	.....
28	2	2d B	Coolidge.....	1:03 p. m.	7933
29	3	2d C	Hallet.....	1:08 p. m.	.....
30	4	2d D	Dodge.....	1:12 p. m.	.....
31	5	2d E	Ward.....	1:14 p. m.	.....
32	6	2d F	Coolidge.....	1:15 p. m.	7934
33	7	2d G	Coolidge.....	1:17 p. m.	7935

#### THIRD APPEARANCE.

34	8	3d A	Chamberlain.....	1:20 p. m.	.....
35	9	3d B	Chamberlain.....	1:24 p. m.	.....
36	10	3d C	Coolidge.....	1:27 p. m.	7935

*Notes on the photographs.*

No. 1. See fig. 27.—*Chamberlain, 2d A*, at 1:02 p. m., showing the waterspout 5.75 miles away, the lower face of the cloud in great detail, the foreground, the schooner about two miles out, and Succonesset Shoal light-ship about eight miles distant; the latter can be seen on the horizon about one third of the apparent distance from the spout to the schooner.

No. 2. See fig. 28.—*Coolidge, 2d B*, at 1:03 p. m., includes the Martha's Vineyard steamer, the spout and cloud in nearly the same condition as shown by 2d A.

No. 3. See fig. 29.—*Hallet-Coolidge, 2d C*, at 1:08 p. m. This picture is attributed to E. K. Hallet, photographer, and is copyrighted by Baldwin Coolidge, Boston, Mass., 1897. It seems to be somewhat later than 2d B because the vortex is leaning more toward the south, in accordance with the drift of the cloud stratum, which is brought out more positively in the third appearance, 1:20 to 1:25 p. m.; it also gives us the dimension of the upper cloud which is not seen in the pictures 2d A, 2d B. Such small-scale photographs of the whole cloud region serve admirably to supplement the details to be found only on the large-scale pictures, and should always be made if possible by those having kodaks at hand.

No. 4. See fig. 30.—*Dodge, 2d D*, at 1:12 p. m., is chiefly of importance in locating the line from the head of Vineyard Haven Harbor to the waterspout. The curvature toward the southwest in the center begins to be seen from that angle. I estimate that this was taken at 1:12 p. m., though there may be some doubt about the exact minute.

No. 5. See fig. 31.—*Ward-Coolidge, 2d E*, probably at 1:14 p. m., taken by F. W. Ward, enlarged and copyrighted by Baldwin Coolidge. The curvature of the tube is now fully seen from Falmouth Heights, where this plate was taken, this sight line being nearly at right angles to those from Cottage City. The vortex column appeared vertical at Cottage City, but strongly curved at Falmouth Heights with convexity toward the southwest. In the third appearance the convexity is seen nearly broadside on at Cottage City, and this indicates some change in the drift of the lower surface of the cloud relative to the layer of air at the water. This photograph gives the horizontal extent of the cloud. The Hallet photograph, fig. 29, 2d C, shows the precipitation in the thunderstorm preceding the waterspout by about one mile.

No. 6. See fig. 32.—*Coolidge, 2d F*, at 1:15 p. m., shows the enlargement of the tube before breaking up, the spray being cast out from all parts of the tube, especially at the top, thus causing the conical form.

No. 7. See fig. 33.—*Coolidge, 2d G*, at 1:17 p. m., gives the phenomenon at the breaking up of the second appearance, and it locates the schooner well up to the place of the vortex.

There are three photographs of the third appearance.

No. 8. See fig. 34.—*Chamberlain, 3d A*, at 1:20 p. m., shows the top of the vortex advanced toward the south relative to the base, indicating the drift in the cloud stratum. The schooner has moved beyond the base of the waterspout and is between the two telegraph poles; a tow of barges is just coming into view on the extreme right of the photograph.

No. 9. See fig. 35.—*Chamberlain, 3d B*, at 1:24 p. m., is similar to the preceding, but the base of the spout has moved toward the southeast; the schooner and the barges are approaching each other.

No. 10. See fig. 36.—*Coolidge, 3d C*, at 1:27 p. m., is a later phase of the third appearance, with the schooner and head of the tow nearly in the same line. The schooner is about two and one-half and the barges about three miles distant from Cottage City.

**POSITION OF THE WATERSPOUT IN THE SOUND.**

It will be seen that from the foregoing notes, the photographs, and the chart we have considerable data with which to find the position of the waterspout in Vineyard Sound. It

will be best first to fix our attention upon the first part of the second appearance as shown in the photograph, Chamberlain, 2d A, fig. 27, taken at about 1:02 p. m. My own personal survey of the ground gives the following distances approximately, as plotted in fig. 26. The telegraph poles are marked 1, 2, 3, 4, and Chamberlain's camera is marked 5. We have the distances, 5-1=450 feet, 5-4=504 feet, 1-2=72 feet, 2-3=120 feet, 3-4=66 feet, 4-1=132 feet. The sight line to the waterspout is laid down, also that to the schooner; the angular distance between them is 5.44°. On photograph, Chamberlain, 2d A, fig. 27, is also shown the Succonesset Shoal light-ship, which appears as a dot on the horizon about one-third the distance from the foot of the spout to the schooner. This enables us to orient the entire drawing with great accuracy. These lines are now transferred to the chart of Vineyard Sound, published by the U. S. Coast and Geodetic Survey as No. 112, August 1901, of which a portion is reproduced as fig. 25.

On photograph, Dodge, 2d D, fig. 30, taken from the head of Vineyard Haven Harbor, the spout is shown just to the south of East Chop light-house, and that line is added to the chart. The spout was also seen from Woods Hole at the head of Little Harbor, and a measurement of the line as described gives magnetic declination S. 75° E., which is also drawn. It was seen from Edgartown, 10° east of true north, by one report, this line being indicated on the chart, fig. 25.

Dr. George Faulkner's family saw the second appearance from their residence near the water in the town of Falmouth, and their sight line passed just south of the steamboat wharf at Falmouth Heights. This enables us to fix another line as shown on the chart. These lines all converge quite accurately to a point a little south of east of L'Hommedieu Shoal, where other observers also placed it by estimate, and I have accordingly cut off the Chamberlain line of sight at that point on my chart, fig. 25. This makes the distance from Chamberlain to the waterspout 5.75 miles, and to the Succonesset Shoal light-ship eight miles; as the schooner was in the usual inside channel it was about two miles distant, as shown on this same chart. It is instructive to note that some spectators imagined the spout to have been more than twenty miles from Cottage City. It is of great importance to be able to accurately convert the distances shown on the photographs into angles, because the angles, combined with the length of the sight line, give the corresponding linear dimensions at the spout and at the schooner. We have to measure the linear distance on this photograph from the middle of the schooner to the middle of the waterspout, which is 48 millimeters on fig. 27, Chamberlain, 2d A; at the same time the angular distance between the sight lines from the camera to these two objects is found from the survey to be 5.44°. This was determined by plotting the lines of the survey on a large scale, and testing the result by numerous checks on the other distances measured on the photographs. Hence, 1 millimeter = 6' 48" of angle. This is the fundamental dimension, and it leads to 1 millimeter = 60 feet = 18.3 meters at the waterspout.

**DIMENSIONS AS MEASURED ON PHOTOGRAPH 2D A, FIG. 27.**

By this process we obtain the absolute dimensions given in the accompanying table.

	Feet.	Meters.
At the distance 500 feet, 1 mm. is equivalent to.....	0.989	0.3014
At the distance of 1 mile, 1 mm. is equivalent to.....	10.444	3.1833
At the distance of the schooner, 1 mm. is equivalent to.....	20.888	6.3667
At the distance of the waterspout, 1 mm. is equivalent to.....	60.00	18.288
Length of schooner hull (3 mm.).....	62.7	19.111
Length of schooner over all (4 mm.).....	83.6	25.481
Diameter of the waterspout at the water (4 mm.).....	240	73.15
Diameter of the foot of the cascade (12 mm.).....	720	219.46
Height of the cascade (7 mm.).....	420	128.02
Diameter of the vortex tube at middle (2.4 mm.).....	144	43.89
Diameter just at face of the cloud (14 mm.).....	840	256.03
Approximate length of the tube (60 mm.).....	3600	1097.3
Approximate height of the top of the cloud (from 2d C, fig. 29) .....	16000	4876.8

Distance from middle of schooner to middle of waterspout on the horizon, measured on the photograph, 48 mm.

Angular distance subtended by the sight lines at the camera, as determined by the local survey,  $5.44^\circ$ .

Hence, 1 mm. subtends  $5.44^\circ \div 48 = 0.1133^\circ = 6.80' = 6'48''$ .

The distance moved by the waterspout from the beginning of the first appearance at 12:45 p. m. to the end of the third appearance at 1:28 p. m. can be found as follows:

The positions of the schooner and the waterspout at the time of taking Chamberlain's three photographs are shown on the chart (see fig. 25), as nearly as can be determined; 2d A, at 1:02 p. m.; 3d A, at 1:20 p. m.; 3d B, at 1:24 p. m. In the interval, 1:02 to 1:24 p. m., 22 minutes, the schooner moved about 0.65 mile. This is at the rate of 1.7 miles per hour. The schooner was sailing nearly east-southeast, and the sails were set to catch a wind from the northwest. The wind was very light at the time, as stated by several observers, and as is shown on the photographs by the smoothness of the water. In the interval, 12:45 to 1:28 p. m., 43 minutes, the vessel passed over the distance 1.27 miles. Similarly, the waterspout passed over the distance 0.4 mile in the interval, 1:02 to 1:24 p. m., and over the distance 0.78 mile, or 4018 feet, in the interval, 12:45 to 1:28 p. m., while the whole phenomenon was in evidence. This is at the rate of 1.10 miles per hour.

It is instructive to compare these results with the estimated dimensions and distances as reported by different spectators. Mr. Hanes estimated the eastward progress as 2 miles, diameter from 100 to 300 feet, height 4000 to 5000 feet. Mr. North made the distance of the waterspout from Cottage City 20 miles, or more, supposing that the foot of the vortex was beyond the horizon, and that from his view-point the base of the tube was 20 feet above the sea level; he made its eastward movement about equal to its own height before it disappeared, which is nearly correct, and called this one mile. Mr. Coolidge, October 19, 1896, estimated the height of the spout at from 6000 to 10,000 feet, or 21 to 28 times its diameter, and the latter at 300 to 375 feet and the distance 8 miles. Mr. Coolidge, September 1, 1897, made it 400 to 600 feet in diameter at its mid-height, from 4000 to 6000 feet, or perhaps 10,000 feet high, and 5 miles distant. The observers on the yacht *Avalon*, which was very near the waterspout, made the diameter 100 feet. Mr. E. H. Garrett estimated over 300 to nearly 500 feet high, and 125 feet in diameter; Mr. John B. Garrett; 6 miles distant, height, 750 feet; diameter, 125 feet; height of cascade, 125 feet; Mr. Abbott; height, 3000 to 4000 feet.

[The treatment of this waterspout will be continued in Sections VII, VIII, and IX.]

#### CLIMATOLOGY OF PORTO RICO FROM 1867 TO 1905, INCLUSIVE.

By Mr. WILLIAM H. ALEXANDER, Observer, Weather Bureau. Dated Burlington, Vt., April 23, 1906.

##### OROGRAPHY AND TOPOGRAPHY.

On pages 522-523 of the *MONTHLY WEATHER REVIEW* for November, 1902, under the heading "The Climatology and Water Power of Porto Rico", may be found a few appropriate remarks introductory to this discussion, particularly as regards the topography of the island. Subsequent to the date of that paper the following places of interest were visited for the purpose of securing additional data: Rio Piedras, Caguas, San Lorenzo, Cidra, Cayey, Aibonito, Coamo, Barranquitas, Barros, Comerio, Bayamon, Carolina, Canóvanas, Fajardo, Hacienda Perla, Manati, Ciales, La Isolina, Morovis, El Yunque, Camuy, Quebradillas, Isabela, Aguadilla, Hacienda Coloso, Aguada (the reputed landing place of Columbus in 1493), Añasco, Mayagüez, Las Marias, Cabo Rojo, San German, Lajas, Hacienda Amistad, Guanica (the landing place of General Miles in 1898), Yauco, Ponce, La Carmelita, Adjuntas, San Salvador, Utuado, and Arecibo. The information thus gained

42—2

seems to warrant a few additional observations relative to the physical features of the island. (See Chart VII.)

In the first place, careful barometric (aneroid) readings made during the journey to the summit of El Yunque (universally regarded as the highest point on the island) seem to indicate beyond a doubt that the true elevation of that mountain is not more than 3300 feet, instead of 6000 as frequently stated in old records. Again, just north of Ponce in the vicinity of La Carmelita, the same barometer gave as the correct elevation of the dividing ridge 2428 feet. It seems proper, therefore, to amend a former statement to the effect that "the dividing ridge varies in height from 2500 to 3670 feet" so as to make the variation from about 2000 to 3300 feet. This dividing ridge from El Yunque to Humacao is known as "Sierra de Luquillo"; from Humacao to Aibonito, "Sierra de Cayey"; and from Aibonito westward, "Cordillera Central". The two most important depressions in this divide are where the San Juan-Ponce Military Road crosses it, between Aibonito and Coamo, and where the Ponce-Arecibo Road crosses, just south of Adjuntas. Just west of Adjuntas there is an abrupt rise in the range second in importance only to El Yunque. The central figure in this group is known as Mount Guilarte which is very nearly as high as El Yunque. This is the true culminating point to the westward, and from a topographic point of view is the dominating factor in the climatology of the west end of the island. From Mount Guilarte a number of rugged spurs or dividing ridges branch off; one toward the northwest corner of the island; one toward the southwest, terminating near Cabo Rojo; and one between these in the direction of the little village of Rincon.

As to the secondary topographic features of the island, no better description, perhaps, can be given than that of Mr. Herbert M. Wilson in *Irrigation Paper No. 32, U. S. Geological Survey*, page 14. He says:

Abutting against the foothills of the commanding sierras, and forming secondary topographic features of striking importance, are a number of varied forms found at different portions of the island, and owing their shape and mode of weathering to their geologic origin. On the north coast, between Arecibo, San Juan, and Fajardo, the main summits fall away rather abruptly to elevations of between 1000 and 1500 feet; they then continue as radial spurs, sloping gently to the northward and interrupted by numerous undulations, culminating often in peaks of considerable altitude and prominence.

These are separated by the principal rivers draining the interior, which flow generally to the north, but are deeply indented in the surface of the country. Thus, within five or six miles to the north of the main summits the river bottoms are at altitudes of about 1000 feet, while the summits of the ridges above are at elevations of 2000 to 2500 feet. Again, within five miles of the coast the river beds are at elevations of 50 to 100 feet above sea level, while the summits of the dividing ridges reach altitudes of 1000 to 1500 feet. These dividing ridges are often maintained to the ocean shore, are high, narrow, and A-shaped, and are separated from one another by deep V-shaped valleys, eroded by numerous streams flowing in every direction throughout the interior of the island.

The coastal topography is more simple and consists in the main of playas, or level plains, that in places extend some five or six miles up the river valleys. The playas do not extend in unbroken continuity around the island, but are interrupted in several places. For instance, at the northeast corner of the island spurs from the Sierro de Luquillo plunge directly into the sea; on the northwest corner there is a coral plateau extending from Arecibo to Aguadilla that juts right out to sea. The south and southwest coasts are peculiar in that the playas are separated from the sea by low-lying limestone hills, which are more pronounced along the southwest coast.

From the above, it would seem that waterfalls must of necessity be common in the rivers of the island. There are many falls and some of considerable importance, especially in the Rio de la Plata and the Arecibo. The river channels lend themselves to dam construction so readily as to make this a matter of comparatively small expense. Springs abound in

Porto Rico and many of them are valuable for their mineral and medicinal properties, while others afford warm baths. Among the most noted are the Coamo Springs, near the town of that name; the warm mineral springs near San Sebastian; the mineral springs at San Lorenzo; the hot springs near Aguas Buenas; and the sulphur baths near Ponce. There are no lakes of importance in the island, the only approach to a lake being in the vicinity of Guanica, where there is a considerable body of water lodged in the lowlands between the coast hills and the foothills of the mountains. There are numerous caves, some very interesting and extensive, and in some cases these afford valuable fertilizing material.

#### TEMPERATURE.

Excessive temperatures are unknown in Porto Rico, as may be seen from the tables herewith. Referring to Table 1, it will be observed from column headed "24-hour mean" that the annual range of monthly means is only about  $5^{\circ}$  for the year and Tables 3 and 5 indicate an extreme secular range at San Juan of  $45^{\circ}$ . The interior mountain stations occasionally, though rarely, report a minimum temperature of  $50^{\circ}$ , from which it may be assumed that the range for the island is about  $50^{\circ}$ . Frosts never occur in Porto Rico, although the natives are sometimes heard to speak of the "rigors of winter", indicating an extreme sensitiveness to temperature changes. From December to April, inclusive, the monthly mean temperature is below the annual mean, and during the remainder of the year is above. January has the lowest and August the highest mean temperature, although there is only  $5.1^{\circ}$  difference. The maximum temperatures for the year usually occur in May, when the sun's rays are about vertical, at which time the temperatures are often very trying. August has the highest mean temperature, but September has the highest mean maximum temperature. The average daily range of the temperature at San Juan is between  $11^{\circ}$  and  $12^{\circ}$ ,<sup>1</sup> but some interior stations have much greater ranges. The records seem to indicate a decrease of about  $4^{\circ}$  for each 1000 feet of ascent. The minimum temperature for the day generally occurs about 5 a. m. and the maximum anywhere from 10 a. m. to 2 p. m. The rise in temperature from 6 to 10 a. m. is very rapid, but the fall is more gradual.

#### RAINFALL.

The rainfall and its distribution over the island constitute the most interesting feature in its climatology, as here we find a variety surpassed only by that of its topography. Local climatic differences, due to peculiar physical features, are apparent in the rainfall of the various sections of the island.

The distribution of the rainfall through the twenty-four hours of the day is fully indicated in Tables 7 and 8. In Tables 9, 10, and 13 are presented data for three selected stations designed to show the amount and its distribution through the year. Three stations were selected because no one seems to be sufficiently representative of the island, as a whole, and these three particular stations were selected because they possess the longest and most reliable records on the island. The San Juan records extend back to 1867, with two or three short breaks; the record at Canóvanas Sugar Factory, though not so long, is continuous and entirely trustworthy, and fairly representative of the sugar belt on the north side. The Perla record is even shorter than the Canóvanas record, but it is representative of the mountain districts where the coffee interests lie.

We note, first, that February is by far the driest month in the year. The so-called dry season begins about November 20 and extends to about April 15 when the rainy season sets in. The rainy season has two periods of maximum fall, one in July and the other in November. By far the greater proportion of the rain falls from May to November, inclusive. The average number of rainy days for the year is 194 at Canóvanas,

<sup>1</sup> This value apparently refers to the nonperiodic range, as the periodic range is  $8.6^{\circ}$ , as given by Table 1. (See Ward's Hann's "Climatology", pp. 13, 18.) — EDITOR.

208 at San Juan (for the four years 1899-1902, inclusive), and 260 at Perla. There is a marked difference in the range of the monthly means at the three stations under consideration. For instance, at Perla the means ranged from 2.39 inches in February to 17.69 inches in November, a difference of 15.30 inches; at Canóvanas the means ranged from 1.80 inches to 11.47 inches, a difference of 9.67 inches; at San Juan there is a range of 3.92 inches in the first set of means and 5.60 inches in the second set. There is a substantial agreement in the February means at all three stations. There is not a single month in the San Juan or Perla record when no rain was recorded and only one, February, 1896, in the Canóvanas record.

The yearly means at San Juan and Canóvanas are practically the same, but at Perla, which is about 500 feet above sea level and on the windward side of El Yunque, there is an increase of more than 60 inches over that of the other two stations. The secular ranges in the annual amounts recorded at the three stations are 46.02 inches at San Juan, 41.70 inches at Canóvanas, and 63.85 inches at Perla.

The distribution of the rainfall over the island becomes an easy inference from what is here said relative to the physical features and the prevailing winds of the island. Available data seem to indicate for the east coast an annual fall of about 92 inches; for the north side, about 86 inches; for the west side, about 86 inches; and for the south side, about 57 inches. There are two places where the fall is considerably in excess of other portions of the island, namely, in the vicinity of El Yunque in the northeast and in the vicinity of Mount Guilarte in the southwest. A careful inspection of the records of stations situated along the north coast shows a gradually diminishing rainfall from Perla to Isabela. A line of central stations, beginning, say, with Humacao, indicates a diminishing fall westward to about midway of the island after which there is an increase until the western culmination (Mount Guilarte) is passed. The fall along the south coast, beginning, say, with Central Aguirre, decreases westward as far as Ponce and then increases quite rapidly. Ponce and vicinity, therefore, seem to constitute the driest portion of the island. In fact the entire south side is subject to frequent and sometimes prolonged droughts, making irrigation quite necessary, for which purpose the supply of water seems to be ample. This difference in the rainfall of the north and south sides is very apparent in the vegetation and general appearance of the two sections.

In Tables 12 and 16 will be found data bearing on excessive precipitation. The years therein given may be taken as fairly representative, with the exception of the year 1899, when the island was visited by a hurricane of unusual violence, that of August 8, 1899, known locally as "San Ciriaco". Chart VIII shows the amount and distribution of rainfall over the island during the passage of this storm.

#### MISCELLANEOUS CLIMATOLOGICAL ITEMS.

*Fogs* are not uncommon in the interior of the island along the river valleys. *Thunderstorms* are not very frequent nor are they, as a rule, very violent. In Table 18 we give the San Juan record of thunderstorms for the seven years 1899 to 1905, inclusive. *Hail* occasionally though rarely accompanies these thunderstorms. An instance of this occurred at Caguas on April 12 and 13, 1903. See *MONTHLY WEATHER REVIEW* for April, 1903, Vol. XXXI, page 233.

The *winds* blow with marked constancy throughout the year, as shown in Table 17. These are the northeast trades modified by local conditions, and at San Juan come quite regularly from the east and are known as the "briza". The evenings are rendered delightfully cool by these winds, and even the hottest day loses its oppressive character to a large degree. The wind is light during the night and fresh during the day. The wind movement is greatest in March and least in October. Destructive hurricanes are rare, as the island is out of the usual path of these disturbances.

TABLE 1.—The mean hourly temperatures, monthly and annual, at San Juan, Porto Rico, based upon a 6-year record, January 1, 1899, to December 31, 1904, inclusive. The readings are from a Richard thermograph, after applying all necessary corrections, read off for each hour of 75th meridian time.

Month.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Mid't.	24-hour mean. †
January	72.5	72.2	71.9	71.8	71.5	71.7	72.8	74.6	77.2	79.6	79.8	80.0	79.9	79.7	78.3	77.1	76.1	75.5	75.0	74.3	73.7	73.2	72.8	75.4	
February	72.5	72.0	71.7	71.4	71.2	71.3	72.8	75.3	78.2	79.6	80.1	80.3	80.6	80.0	79.4	78.0	76.6	75.8	75.3	74.5	73.9	73.8	72.8	75.7	
March	72.1	71.8	71.4	71.2	71.0	71.1	73.2	75.8	78.1	79.1	79.5	80.0	80.0	79.7	79.1	78.4	77.2	76.1	75.4	75.1	74.4	73.8	73.3	72.8	75.4
April	73.5	73.1	72.6	72.6	72.4	73.1	75.4	78.0	79.8	80.6	81.2	81.5	81.7	80.7	79.9	78.8	77.6	76.8	76.4	75.7	75.2	74.6	74.1	77.0	
May	75.0	74.7	74.4	74.2	74.0	75.2	77.8	80.1	82.4	82.9	83.1	82.6	82.6	82.0	81.4	80.5	79.2	78.3	77.8	77.1	76.5	76.1	75.5	78.6	
June	76.5	76.2	75.9	75.6	75.5	75.6	78.4	80.9	82.5	83.0	83.5	83.6	83.8	83.6	83.6	82.8	82.1	81.1	80.0	79.0	78.7	78.0	77.7	79.6	
July	77.2	76.8	76.6	76.3	76.2	77.0	79.0	80.7	82.3	83.1	83.5	83.7	83.6	83.3	82.8	81.4	80.4	79.8	79.6	79.0	78.8	78.2	77.7	80.0	
August	77.6	77.3	77.0	76.7	76.5	77.0	79.0	81.2	82.8	83.7	84.0	84.2	84.4	83.8	83.2	82.6	81.8	80.7	80.0	79.8	79.3	78.9	78.6	80.4	
September	76.9	76.4	76.3	76.0	75.9	76.5	78.6	80.8	83.3	84.1	84.5	84.6	84.2	83.8	83.2	82.4	81.4	80.5	79.7	79.6	79.8	79.3	80.0	80.4	
October	75.8	75.5	75.2	74.8	75.0	75.2	77.6	79.8	82.9	83.7	83.9	83.6	83.5	83.6	82.5	81.6	80.3	79.4	78.7	78.3	77.5	76.6	75.3	79.0	
November	75.0	74.7	74.4	74.1	73.9	74.3	76.2	78.0	81.2	82.0	82.4	82.7	82.8	82.4	81.3	80.6	79.2	78.5	78.0	77.6	76.8	76.3	75.8	78.4	
December	73.5	73.2	72.8	72.7	72.5	72.8	73.9	75.7	79.3	80.5	80.8	81.0	81.2	80.6	80.0	79.1	77.9	76.9	76.5	76.2	75.2	74.7	73.7	76.5	
Year	74.8	74.5	74.2	74.0	73.8	74.1	76.2	78.4	80.8	81.7	82.2	82.4	82.4	82.0	81.4	80.7	79.6	78.5	77.8	77.4	76.8	76.3	75.8	78.0	

† The means in the right-hand column, being found from the hourly temperatures, differ slightly from means for the same series of months and years computed from the data of Table 2; because the latter are based on daily means obtained by the formula,  $\frac{1}{2}$  (maximum temperature + minimum temperature), which is used in the regular climatological work of the Weather Bureau. —EDITOR.

TABLE 2.—The monthly mean temperatures at San Juan, Porto Rico, from April, 1872, to May, 1896, under the Spanish Government, and from November, 1898, to December, 1905, under the U. S. Weather Bureau.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872	o	o	o	o	o	o	o	o	o	o	o	o	o
1873	76.8	76.4	77.0	79.3	80.9	82.8	84.1	82.3	82.6	80.1	77.6	80.3	80.3
1874	77.0	77.0	77.7	79.3	81.6	83.0	84.2	84.0	83.0	82.0	77.8	80.6	80.6
1875	76.4	76.9	77.6	78.6	81.7	83.8	84.2	83.0	83.0	82.0	80.0	80.6	80.6
1876	79.0	78.2	79.6	81.7	84.6	84.0	84.4	85.4	84.8	84.7	82.2	80.2	82.4
1877	79.5	81.0	81.0	82.0	84.6	85.6	85.6	86.4	84.1	81.9	79.9	83.0	83.0
1878	78.6	78.3	78.8	80.7	81.7	83.7	84.8	83.8	81.0	79.3	77.4	80.2	80.2
1879	73.8	72.3	74.8	73.4	79.1	81.1	81.8	82.5	82.0	81.2	80.2	77.9	78.3
1880	77.4	75.9	77.7	79.6	80.6	81.7	81.9	82.1	82.2	80.7	78.5	76.5	79.6
1881	76.1	75.0	75.7	78.1	80.5	82.6	81.8	82.8	81.9	82.5	79.6	79.2	79.6
1882	77.5	76.4	77.4	79.4	81.5	81.1	81.3	82.5	82.6	81.8	79.4	75.7	79.7
1883	77.1	76.0	79.1	78.0	81.1	82.5	81.7	81.5	81.4	80.6	79.5	76.8	79.6
1884	75.6	75.3	76.0	77.3	80.4	80.5	81.7	82.4	81.7	80.9	80.1	77.8	79.1
1885	74.3	74.7	75.1	75.8	78.1	79.6	80.8	81.5	81.7	81.7	80.0	78.0	79.1
1886	74.9	76.2	76.2	77.3	79.1	80.5	80.8	80.3	81.0	79.7	78.5	78.4	78.4
1887	74.3	74.7	75.1	75.8	78.1	79.6	80.8	81.5	81.7	81.7	80.9	77.8	77.9
1888	74.8	74.3	75.0	75.4	77.4	78.2	80.6	80.7	80.7	79.8	78.8	78.1	78.1
1889	76.9	77.1	77.4	78.9	82.1	81.6	79.9	80.6	79.7	80.6	78.7	75.7	79.1
1890	74.4	73.8	74.5	74.8	77.1	78.4	78.7	78.4	78.2	78.8	77.3	76.6	76.8
1891	73.3	73.7	74.6	76.7	77.3	78.9	79.4	79.1	80.1	80.0	77.8	74.8	77.1
1892	73.8	72.8	74.3	74.1	76.1	77.2	78.4	78.4	78.7	76.4	72.8	72.2	75.2
1893	72.1	73.1	72.2	72.5	74.4	75.9	78.9	77.4	77.3	76.6	75.0	72.5	74.8
1894	70.8	70.5	70.4	73.1	71.6	75.7	75.6	76.8	76.6	74.6	71.6	73.7	73.7
1895	69.9	71.1	72.8	74.2	74.6	76.1	76.0	76.8	76.7	76.8	74.7	73.0	74.4
1896	71.9	72.6	74.1	74.4	76.4	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
1897	77.2	75.9	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
1898	77.0	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7
1899	77.0	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7
1900	77.0	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7
1901	77.0	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7
1902	77.0	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7
1903	77.0	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7
1904	77.0	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7
1905	75.4	75.0	75.2	75.8	78.3	79.8	79.5	79.0	78.7	78.7	78.4	77.0	77.0
Mean *	75.8	76.0	74.6	77.1	79.2	80.4	80.1	80.5	80.4	80.4	79.9	78.4	78.4
Dept. *	—2.6	—2.4	—3.8	—1.3	+0.8	+2.0	+1.7	+2.1	+2.0	+1.5	+0.1	—1.5	—1.5

\* The means are for the lustrum 1901-1905. The bottom line gives the monthly departures from the annual mean.

TABLE 3.—The maximum temperatures at San Juan, Porto Rico, for each month from August, 1872, to December, 1895 (Spanish records), and from November, 1898, to December, 1905 (U. S. Weather Bureau records).

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
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TABLE 5.—The minimum temperatures at San Juan, Porto Rico—Cont'd.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1876...	60	60	68	72	73	73	74	74	73	73	72	70	...
1877...	69	69	70	71	72	74	74	76	75	75	71	66	66
1878...	69	70	71	72	74	75	72	74	75	72	73	69	69
1879...	66	65	69	71	71	73	72	72	69	70	68	65	65
1880...	65	63	66	67	69	66	69	72	70	71	70	67	63
1881...	65	64	65	66	69	72	67	67	71	69	69	64	64
1882...	66	64	65	65	69	72	72	73	69	72	68	69	64
1883...	68	64	66	68	70	69	68	68	67	71	68	67	64
1884...	64	65	66	65	68	71	70	68	70	66	66	64	64
1885...	66	63	64	64	70	72	73	69	73	70	71	67	63
1886...	63	67	68	68	69	70	69	69	72	70	68	67	63
1887...	66	65	63	67	69	72	72	73	71	69	66	63	63
1888...	65	64	63	65	67	71	73	70	72	72	70	69	63
1889...	66	66	65	68	69	70	72	72	70	70	68	67	65
1890...	66	66	63	65	69	69	70	60	68	68	68	63	63
1891...	65	64	64	66	68	65	71	70	70	70	67	62	62
1892...	63	61	64	65	64	65	68	65	62	61	59	56	56
1893...	61	63	61	62	63	65	64	66	65	64	62	62	61
1894...	57	59	57	59	61	64	64	64	65	62	64	58	57
1895...	58	58	60	61	63	66	65	66	65	64	62	58	58
1896...	...	...	...	...	...	...	...	...	...	...	...	...	...
1897...	...	...	...	...	...	...	...	...	...	...	...	...	...
1898...	...	...	...	...	...	...	...	...	...	...	...	...	...
1899...	66	66	66	66	68	71	70	71	71	68	70	65	65
1900...	68	66	67	68	69	70	70	70	72	70	70	66	66
1901...	67	67	67	70	70	70	70	70	71	71	70	68	67
1902...	67	66	67	68	68	71	71	71	72	72	69	66	66
1903...	68	69	65	69	66	71	72	71	72	68	70	68	65
1904...	67	66	66	67	70	70	71	68	71	71	72	70	66
1905...	66	67	66	69	70	73	70	70	71	70	68	66	66
Low'st	...	...	...	...	...	...	...	...	...	...	...	...	...
(a)...	57	58	57	59	61	64	64	64	62	61	59	56	56
(b)...	66	66	63	66	66	70	70	68	70	68	69	65	65

(a) Lowest during 1872-1895. (b) Lowest during 1898-1905.

TABLE 6.—The dates on which the minimum temperatures were recorded at San Juan, Porto Rico, for each month from August, 1872, to December, 1895 (Spanish records), and from November, 1898, to December, 1905 (U. S. Weather Bureau records).

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1872	21	26	23	5	30	1†	25	4	6	27	29	14†
1873	21	26	10†	4†	26†	17	3†	15	17†	13	30	21
1874	9	16	20†	4	14†	26	...	...	...	...	...	...
1875	28	17	23	4	14†	26	...	...	...	...	...	...
1876	...	...	...	...	...	...	...	...	...	...	...	...
1877	25	4†	15	2	2	15	10	12†	9	31	27	25
1878	25	3	8	1†	21	2	9	10	7	17	22	18
1879	31	1†	8†	26	6†	4	31	18	11	28	16	27
1880	30	26	29†	21	4	30	18	22†	28	11	11	19
1881	20†	21	4	25	16	16†	19†	28	2	11	30	...
1882	1†	25	14	10	12	19	31	20†	25	17†	5	15†
1883	20	28	8	16†	20	10†	31	1	8	12	26	10
1884	4	8	13	16	1	29	1†	20	20†	19	9	10
1885	2	3	4	24	2	3†	8	20	25	21	14†	30
1886	7	27	19	15†	16	4	11	15	26	8	6	6
1887	17	17	12	3	10	21	31	1	15	29	26	5†
1888	25	17	4	6	2	29	1	13	29	21	21†	24†
1889	7	7	26	7	9	16	1	22	3	4	27	10
1890	4	25	12	5	3	18	4	21	3	3	20	8
1891	7	24	19	3	3	6	9	20	12	8	23	27
1892	31	23	27	9	8	23	22	25	24	2	30	6
1893	5	7	8	4	25	6	6	18	30	26	24	6
1894	20	7	13	22	3	13	28	12	15	13	26	29
1895	12	6	18	1	23	1	30	6	30	3	28	3
1896	...	...	...	...	...	...	...	...	...	...	...	...
1897	19	28	8	4	1	6	8	20	30	1	19	26
1898	15	19	7	8	31	1	15	9	2	24	29	26
1899	28	13	19	1	25	15	6	22	25	3	26	14
1900	25	3	31	28	16	16	23	31	31	31	23	20
1901	3	17	12	14	3	25	10	22	28	21	28	3
1902	29	25	2	4	14	25	31	12	4	22	30	21
1903	17	23	19	3	9	5	10	6	29	28	28	26
1904	...	...	...	...	...	...	...	...	...	...	...	...
1905	...	...	...	...	...	...	...	...	...	...	...	...

† And other days.

TABLE 7.—The amount of rain, in inches, that fell during each hour of the day, 75th meridian time, for each month\* of the year 1902, at San Juan, Porto Rico (from U. S. Weather Bureau records).

Month.	0 to 1 a.m.	1 to 2 a.m.	2 to 3 a.m.	3 to 4 a.m.	4 to 5 a.m.	5 to 6 a.m.	6 to 7 a.m.	7 to 8 a.m.	8 to 9 a.m.	9 to 10 a.m.	10 to 11 a.m.	11 to noon.	Noon to 1 p.m.	1 to 2 p.m.	2 to 3 p.m.	3 to 4 p.m.	4 to 5 p.m.	5 to 6 p.m.	6 to 7 p.m.	7 to 8 p.m.	8 to 9 p.m.	9 to 10 p.m.	10 to 11 p.m.	11 to Mid't.	Total 24 hrs.
January...	.46	.33	.27	.54	.77	1.16	.21	.55	.32	.02	1.54	.74	.40	.26	.10	.17	.49	1.65	.48	.40	.27	.98	.22	.12	12.45
February...	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0.09	
March...	.11	.78	.36	.15	.24	.19	.04	.06	.04	.24	.02	.07	.20	.00	.11	.01	.01	.10	.00	.05	.31	.64	.30	.05	4.08
April...	.81	.08	.02	.17	.30	.54	.55	.12	.04	.01	.21	.23	.23	.16	.21	.60	.75	.41	.05	.05	.21	.27	.04	.24	6.30
May...	1.10	1.08	.79	.00	.26	.01	.00	.02	.03	.79	.08	.04	1.82	1.43	2.07	.68	.64	.05	.33	.03	.59	1.09	.74	13.76	
June...	.44	.19	1.29	1.13	1.19	.37	.22	.24	.05	.31	.09	1.78	.79	.27	.34	.70</									

TABLE 9.—The monthly rainfall, in inches, at San Juan, Porto Rico, from June, 1867, to December, 1905. (The record was kept under the direction of the Spanish Government from June, 1867, to March, 1898, and by the U. S. Weather Bureau from November, 1898, to December, 1905. Partial or broken records were not considered in obtaining the means of the Spanish record. The Weather Bureau means are only for the regular lustrum 1901-1905.)

In the Spanish records local time of the 66th meridian was probably used. From November, 1898, to the end of 1904, 75th meridian time was used, the "rainfall month" ending at 8 p. m. of the last day. In 1905, 60th meridian time was used, the month extending from midnight to midnight.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1867	.....	.....	.....	.....	6.09	3.23	2.48	2.24	5.08	9.90	1.79	.....	.....
1868	2.40	1.22	2.38	4.45	0.83	1.36	3.91	3.34	6.36	12.96	5.31	1.25	45.77
1869	5.46	2.60	2.23	3.92	1.48	4.18	7.99	7.06	5.58	6.14	7.39	4.17	58.15
1870	4.51	0.85	1.95	3.88	5.00	4.95	7.14	5.13	4.45	6.92	10.60	4.70	60.08
1871	4.69	2.36	2.41	5.14	3.72	1.13	6.15	7.66	3.33	8.31	7.67	4.55	57.12
1872	1.52	4.52	1.27	4.17	4.30	5.69	5.31	4.47	5.58	8.53	5.92	5.05	56.33
1873	2.23	2.84	4.45	0.83	3.78	1.04	3.15	4.31	7.21	2.82	2.39	3.20	37.25
1874	2.10	4.31	1.65	1.46	4.39	5.03	3.73	5.91	3.96	4.01	6.61	3.07	46.25
1875	4.59	1.68	2.23	0.58	1.32	2.88	.....	.....	.....	.....	.....	.....	.....
1876	.....	.....	.....	.....	.....	.....	4.93	4.29	10.01	3.12	7.50	3.20	.....
1877	3.21	5.26	2.60	7.61	1.05	7.32	8.88	3.25	4.68	9.63	6.53	6.35	66.37
1878	2.78	1.59	12.41	4.10	10.27	8.17	11.57	5.53	5.39	11.98	6.84	2.03	82.66
1879	3.50	1.45	4.31	11.77	12.25	8.91	5.76	8.40	3.77	4.46	11.73	3.51	79.82
1880	2.59	1.98	0.51	1.62	8.23	5.45	5.26	5.69	3.52	1.97	6.84	2.25	45.81
1881	1.07	2.15	0.41	3.72	5.74	7.00	6.20	5.81	9.54	15.67	8.84	3.30	69.45
1882	2.16	7.93	2.29	1.78	3.61	1.28	8.50	5.52	3.59	1.54	6.63	2.00	46.83
1883	6.05	4.81	3.77	2.06	5.02	5.54	10.16	9.96	3.86	5.55	4.66	17.66	79.10
1884	3.49	3.37	1.39	2.62	6.24	4.43	4.35	4.03	5.98	8.00	3.01	3.98	50.89
1885	2.41	1.21	1.07	1.33	1.98	2.82	3.50	3.50	7.38	6.78	5.91	5.49	43.38
1886	2.66	1.85	6.76	3.95	0.99	6.20	5.86	10.32	6.17	11.91	9.64	6.11	72.42
1887	2.82	2.30	0.48	1.93	5.81	6.52	6.85	3.93	3.15	3.27	8.32	2.28	47.64
1888	2.13	0.93	1.37	4.89	3.88	5.32	2.48	6.53	7.73	4.64	3.40	5.51	48.81
1889	2.35	1.30	1.10	4.50	9.43	12.72	4.45	6.22	7.41	4.68	4.53	4.50	63.19
1890	8.60	2.91	2.69	6.42	1.90	6.19	4.82	5.69	3.15	2.55	2.90	4.88	50.90
1891	1.38	1.24	0.29	1.91	4.91	4.62	5.21	17.07	4.01	8.81	10.90	4.28	64.63
1892	1.89	0.35	1.01	2.10	9.09	2.34	5.56	4.28	4.69	2.96	7.25	1.90	43.42
1893	0.67	3.33	0.42	3.53	2.39	2.67	4.88	6.61	2.73	4.32	1.84	3.25	36.64
1894	1.77	1.08	1.26	2.88	5.74	5.40	7.53	4.45	5.21	3.29	4.44	5.28	48.33
1895	2.93	0.70	1.39	7.37	6.45	1.17	3.30	3.04	2.91	4.12	4.48	4.81	42.65
1896	1.26	0.24	0.76	1.72	1.08	.....	.....	.....	.....	.....	.....	.....	.....
1897	2.44	0.21	1.54	3.72	6.38	5.35	6.27	7.18	4.06	1.30	4.61	2.45	45.51
1898	1.81	1.24	2.57	.....	.....	.....	.....	.....	12.08	5.34	.....	.....	.....
1899	2.92	0.80	2.29	6.09	2.59	7.23	7.53	10.32	13.66	10.21	11.81	2.10	77.61
1900	3.93	2.13	1.57	5.92	3.83	7.53	6.33	7.00	3.05	8.11	4.50	2.39	56.29
1901	4.30	0.50	4.60	1.11	4.84	7.05	10.98	8.59	7.39	8.30	9.55	8.43	75.70
1902	12.45	0.09	4.08	6.09	13.97	12.22	4.61	4.66	4.85	3.13	5.65	7.16	78.96
1903	2.09	1.44	4.26	3.07	4.54	2.18	7.13	8.41	5.18	5.87	6.41	9.48	60.01
1904	4.07	6.48	3.35	3.97	5.03	3.28	4.70	9.87	6.06	3.55	5.83	1.94	58.13
1905	3.95	2.46	3.01	2.29	6.42	2.61	7.60	7.43	7.15	10.25	5.33	2.85	61.35
Means (a)	2.96	2.40	2.35	3.77	4.99	4.92	5.88	6.10	5.01	6.15	6.27	4.36	55.16
(b)	5.38	2.19	3.86	3.31	6.96	5.47	7.00	7.79	6.12	6.22	6.53	5.97	66.83

\*In the data for 1902 slight discrepancies from the figures of Table 7 may be noted. Thus, as 0.21 inch fell between 8 p. m. and midnight, 75th meridian time, April 30, that quantity is attributed in Table 9 to May, but in Table 7 to April; similarly for 0.18 inch on November 30 and 0.01 inch on December 31.

(a) Spanish record, 27 years. (b) U. S. Weather Bureau record, 5 years.

TABLE 10.—The rainfall, in inches, at Canóvanas, Porto Rico, for each month from August, 1889, to December, 1905, and the monthly and annual averages for 16 years, 1890 to 1905, inclusive.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1889	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1890	13.14	3.70	4.77	5.13	2.45	2.25	7.59	5.58	5.40	2.46	3.69	9.64	65.80
1891	6.15	3.10	0.22	4.34	2.07	8.48	15.69	19.13	7.27	6.35	14.39	6.72	93.91
1892	1.69	1.04	1.28	3.06	12.23	6.90	7.17	4.08	7.71	6.16	12.63	2.30	66.24
1893	0.92	7.23	1.31	4.77	5.73	4.79	10.93	6.00	3.34	2.76	2.89	3.63	54.30
1894	1.91	2.78	2.68	4.59	7.45	4.60	6.16	3.05	5.60	8.27	7.51	9.18	63.76
1895	3.98	0.84	2.72	12.75	9.87	7.38	6.33	6.73	8.64	12.71	17.28	96.00	.....
1896	2.79	0.00	3.15	2.60	8.81	7.87	12.64	12.99	4.46	3.35	20.82	5.61	85.09
1897	9.30	0.50	0.42	0.64	15.74	2.92	10.45	4.41	6.47	1.59	11.33	8.09	71.86
1898	4.81	0.54	0.25	1.01	3.16	3.04	24.57	12.10	7.03	5.33	12.76	4.97	79.57
1899	4.11	1.37	5.00	11.77	2.27	8.01	10.20	12.58	8.76	5.03	22.22	3.23	94.55
1900	5.54	1.94	1.62	9.49	5.57	10.85	9.49	11.01	5.55	15.33	5.97	4.09	86.45
1901	2.98	0.10	6.33	0.41	4.34	9.93	17.43	6.68	10.81	11.89	10.65	5.77	87.27
1902	8.04	0.28	6.47	10.47	12.70	13.87	6.10	3.34	5.91	1.91	11.49	6.59	87.17
1903	2.19	1.79	1.34	3.70	0.93	5.04	8.88	11.33	2.57	5.63	6.85	15.08	68.33
1904	3.53	4.80	7.40	3.80	2.08	3.89	9.42	10.23	8.19	10.08	7.91	3.20	74.53
1905	8.33	2.03	5.38	2.77	10.25	2.51	6.33	12.21	8.83	9.82	6.55	3.18	78.31
Averages	4.96	2.00	3.15	5.08	6.60	6.40	10.59	8.84	6.73	6.54	10.65	6.72	78.31

TABLE 11.—The number of days on which .01 inch, or more, of rain fell at Canóvanas, Porto Rico, for each month from August, 1889, to December, 1905. The averages are for 16 years, 1890 to 1905, inclusive.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.


<tbl\_r cells="14" ix="2" maxcspan

TABLE 13.—The rainfall, in inches, at Perla (or Hacienda Perla), Porto Rico, for each month from January, 1896, to July, 1904. (This station is situated about 500 feet above sea level on the windward side of El Yunque, the highest mountain in Porto Rico). The averages are for the 8 years, 1896 to 1903, inclusive.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1896...	4.54	3.34	4.17	5.34	10.44	7.70	18.36	17.18	12.26	6.54	23.08	11.59	124.54
1897...	13.16	2.87	5.67	13.71	32.89	3.93	10.45	7.62	10.31	11.83	15.57	9.77	135.88
1898...	6.81	2.50	5.27	9.98	7.62	8.92	18.40	12.57	9.95	20.71	16.85	9.27	212.88
1899...	4.74	3.07	5.98	16.45	7.9	11.17	10.60	13.65	14.93	17.74	29.52	4.86	199.55
1900...	9.69	9.17	5.26	23.08	19.14	18.14	12.23	18.83	12.07	16.88	7.55	6.57	146.71
1901...	5.57	1.52	9.47	5.56	17.64	24.64	33.57	7.80	16.78	15.08	18.30	13.03	168.96
1902...	12.56	0.26	7.69	9.40	19.62	33.30	9.77	7.17	9.70	6.31	12.96	12.01	140.75
1903...	3.66	2.34	3.73	7.51	10.34	7.47	14.47	11.21	6.41	13.64	10.14	14.19	105.11
1904...	4.78	8.53	11.23	11.35	10.36	6.58	8.51	....	....	....	....	....	....
Aver- ages	7.59	2.28	5.67	10.50	15.56	14.41	15.98	11.25	11.56	13.57	16.74	10.16	135.38

TABLE 14.—*The number of days on which .01 inch, or more, of rain fell for each month from January, 1896, to July, 1904, at Perla, Porto Rico. The averages are for the years 1896 to 1903, inclusive.*

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1896 ..	21	16	22	17	26	21	30	24	25	23	26	27	279
1897 ..	19	12	12	17	26	16	25	20	20	21	21	24	245
1898 ..	20	13	17	15	12	18	26	20	20	22	26	24	228
1899 ..	26	18	24	17	20	30	30	27	27	19	19	27	279
1900 ..	29	23	20	29	28	25	30	26	28	29	29	30	326
1901 ..	23	13	17	9	21	27	24	21	18	22	21	28	244
1902 ..	37	3	17	19	21	23	19	18	15	20	17	22	239
1903 ..	14	18	19	18	14	19	26	25	21	21	23	24	239
1904 ..	19	23	27	21	22	18	21	16	22	23	24	24	258
Averages	22	14	18	18	21	23	26	16	22	23	24	24	258

TABLE 15.—*The average monthly rainfall, in inches, at a number of places in Porto Rico, based upon records at the U. S. Weather Bureau station, San Juan, Porto Rico.*

Stations.	No. of complete years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
<i>North side.</i>													
Adjuntas.	4	4.38	0.86†	2.68†	7.29	10.52	12.66	9.99	16.89	10.92*	11.79	8.79	4.15
Arecibo.	32	5.01	0.92†	4.75†	5.97	7.01	5.43	6.04	4.84	4.30	6.64	9.58	6.51
Barros.	2	6.45	0.81	2.50	2.98	23.30	8.72	8.28	3.40	6.62	11.40	12.92	4.30
Bayamon.	4	4.66	0.76	4.22	5.97*	9.86	13.42	7.57	11.77	9.78	8.81	11.27	6.59*
Caguas.	3	6.02	1.23	2.17†	6.22*	6.09†	12.35†	10.90†	5.93	6.61†	10.74	6.98	-----
Canovanas.	14	4.82	1.87	2.79*	5.46*	7.11*	6.95*	10.87*	7.86	7.06	5.79	10.80	6.98
Cayey.	6	3.81	1.59	2.39†	5.58	7.33	11.02*	8.54†	10.20*	7.143	6.783	7.633	3.753
Cidra.	3	5.50	0.61	5.50	3.50*	8.06*	16.61	10.16†	7.65	5.36†	6.66†	6.91	6.70*
Corozal.	8	5.90†	1.84†	5.14†	8.46	12.17	8.49	12.43	6.86*	6.67	11.98*	11.62	6.00
Isabela.	4	6.76	1.51†	2.12†	4.98	5.00	6.21	3.52	7.06	4.21	5.39	10.26	5.78
La Isolina.	4	6.12	1.05	5.78	5.81	18.61	9.24	6.62	9.41	11.50	10.47	10.71	6.69
Manati.	4	4.38	1.03	5.45	5.85	6.79	7.29	8.00	6.29	7.64	6.76	11.48	5.44
Morovis.	3	4.22	1.55	7.21	6.89	14.18	5.61	7.09†	8.15	7.48†	10.60†	5.09*	2.44*
Perla.	7	8.02	2.38†	5.67†	10.95	16.31	15.40	16.20	11.26	12.29	13.56	17.97	9.59
San Juan.	4	5.15†	0.99†	3.36†	4.80	6.31	8.51	7.36	7.66	7.24	7.44	8.72†	5.08†
San Lorenzo.	3	3.96†	1.39†	3.54†	6.01	7.14	20.46	10.18	8.84	9.84†	9.29†	7.51†	4.71†
San Salvador.	2	3.45	0.56	1.69	7.81*	17.86*	9.90	6.64	5.66	14.89	9.78	9.96	5.77
Utuado.	4	3.08*	0.45	2.98†	5.08	11.23	8.74	4.93	4.87*	9.70*	14.263	10.40	2.80
<i>East side.</i>													
Fajardo.	4	4.48†	0.85†	2.63†	6.91*	6.04	11.17	7.82	5.15	6.88*	9.70*	11.19	4.87*
Humacao.	3	6.01†	1.07†	3.04†	7.84	14.66	18.91	10.02	9.06	10.30	10.14	11.67	4.60†
Maunabo.	3	6.08†	1.86†	2.94†	3.79	9.22	17.21	8.81*	5.79	8.05	10.52	9.67	5.56
<i>South side.</i>													
Aguirre.	4	1.68*	0.94	0.87*	3.55*	3.22*	17.46*	6.05	6.67	7.68	6.75	3.74	2.23*
Coamo.	3	7.10*	0.70	0.93	3.90	7.89	10.76	5.27	6.00	6.67	7.90	7.85*	7.31*
Guanica Central.	4	0.73	0.74	2.65†	2.83	2.63	2.58†	1.30	3.73*	3.45*	5.96*	4.62	1.95
Juana Diaz.	22	2.40	0.20	1.01†	3.62	7.52†	11.14†	3.29	9.72	8.14	7.12	6.69	1.87†
Ponce.	7	1.33	0.50	0.87*	2.33	6.15	8.27	3.80*	3.32	7.03*	5.31*	2.69*	2.93*
Santa Isabel.	2	2.66*	0.34	0.56	4.08*	0.45*	8.96	3.64	2.84	6.68	5.67	5.32	2.96
Yauco.	3	3.37†	0.56†	2.54	3.20	5.36	9.93†	6.38	3.41	5.64	4.27	4.08†	2.01†
<i>West side.</i>													
Aguadilla.	4	3.86	0.87	3.11	5.16	8.25	11.83*	4.84*	9.56†	5.99*	6.13*	7.00	3.50
Amistad.	4	2.72*	0.97†	1.82†	2.28*	5.67*	9.44*	4.66*	8.18	5.42	6.57	6.84	3.10†
Cojoba.	3	3.68	0.92†	2.82	6.36	10.03	11.48	8.04†	8.32†	10.97†	8.86†	8.58	3.17†
Las Marias.	2	2.22	0.36	2.21	6.50*	31.87*	7.22	12.20	12.86	14.14	11.54	11.90	5.76
Mayaguez.	4	2.62	0.59	2.31	6.73*	11.52*	16.89	13.05	12.18	9.35*	9.60	7.12	2.95
San German.	2	2.31	0.89	2.34†	8.36†	6.911	12.38	5.28	6.34	3.71	7.71†	6.74†	7.15

NOTE.—When the number of years used in computing the mean differs from that given in column headed "No. of years", it is indicated by the notes \*, †, ‡, †, ‡, †, ‡.

- Based on observations for one less than the full number.
- † Based on observations for one more than the full number.
- ‡ Based on observations for two less than the full number.

The rainfall for May, 1902, is believed to be much above the true average.

<sup>4</sup> Based on observations for four years less than the full number.

TABLE 16.—*The greatest daily rainfalls, in inches, for each month during the years 1899–1905, respectively.*

TABLE 16.—*The greatest daily rainfalls, in inches—Continued.*

Year and station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
<b>1899.</b>												
<i>South side.</i>												
Aguirre												
Coamo												
Juana Diaz												
Ponce												
Yankee												
<i>West side.</i>												
Aguadilla												
Amistad												
Coloso												
Mayaguez												
San German												
<b>1900.</b>												
<i>North side.</i>												
Adjuntas	1.44	0.23	0.74	3.56	2.70	5.93	2.17	11.54	0.73	2.01	0.50	0.47
Arecibo	0.24	0.92	2.13	1.30	2.70	0.96	1.10	0.60	0.90	2.35	4.00	
Bayamon	0.95	0.48	0.61	3.48	2.53	1.55	0.95	2.31	3.22	1.41	3.10	3.70
Caguas	0.30	0.40	0.28	7.00	5.60	8.05	4.10	1.35	1.35			
Canovanas	1.35	0.40	0.96	6.25	1.80	2.44	1.35	3.22	1.92	2.60	2.40	1.25
Cavey	0.80	0.65	0.25	4.30			2.30	2.15	0.85	0.96	0.43	
Cidra							2.00	4.32	3.10	2.25	1.70	0.70
Corozal	2.30	0.50	1.10	2.00	2.20	1.80	1.60	2.00	1.10	2.20	3.80	1.50
Isabela	0.67	0.74	0.24	2.36	0.68	2.66	1.12	2.32		0.30	1.90	1.90
La Isolina	1.46	0.32	1.22	0.76	2.88		1.86	1.27	3.57	1.38	2.62	0.82
Manati	0.80	0.60	0.30	2.15	2.87	2.80	1.40	1.58	2.90	1.58	2.45	3.10
Morovis	0.86	0.84	0.89	1.80		2.62	0.84	2.14	1.24	2.15		
Perla	1.37	0.63	2.84	10.70	4.09	4.81	2.35		3.16	2.50	1.42	0.78
San Juan	0.75	0.70	0.71	1.91	1.00	2.23	1.19	2.16	1.45	3.35	1.69	0.71
San Lorenzo	0.88	0.61	0.17	8.31	2.05	2.85	7.25	3.11	1.12	2.88	1.21	1.66
Utuado				0.25	1.00	2.00	2.08	1.03	0.83	1.61	2.00	0.48
<i>East side.</i>												
Fajardo	1.00	0.10	1.40	8.45	0.80	3.30	1.50	2.00	3.50	1.61	0.50	0.78
Humacao	0.95	0.63	0.83	6.60	5.50	4.84	5.10	1.41	1.27	0.82	0.06	2.00
Maunabo	1.30	0.30	0.92	2.00	1.49	1.90	2.60	1.20	2.00	2.17	1.37	1.29
<i>South side.</i>												
Aguirre												
Coamo	0.12		0.09	2.18	1.65	2.15	4.30	3.40	3.25		0.20	
Guayama			T.	2.40	3.01	4.00	4.40	4.60	1.00	0.98	4.00	0.12
Juana Diaz										4.00		
Ponce	0.15		0.00	1.40	1.64	4.80	4.58	1.08				0.30
Yauco	1.80	0.20	0.06	0.82	0.87	7.95	3.03	1.08	0.94	1.42	0.85	1.50
<i>West side.</i>												
Aguadilla	0.75	1.00	0.18	1.52	1.10	2.45	2.02	2.20	1.45	1.15	0.65	1.35
Amistad	1.00	0.60	0.40	0.80	1.40	6.00	2.00	1.20	2.00	1.21	1.41	2.10
Coloso	0.51	0.24	0.45	2.15	1.70	2.31	1.93	2.00	2.17	1.86	0.59	0.70
Mayaguez	0.48	0.85	1.12	1.23	1.97	3.45	2.02	3.00	1.84	2.75	0.65	2.10
San German	0.72	0.22	1.62	0.95	2.52	6.85	1.30	0.57	1.02	2.04	1.21	
<b>1901.</b>												
<i>North side.</i>												
Adjuntas	1.80	1.13	2.30	0.35	1.55	0.80	2.30		10.00	2.18	4.90	1.65
Arecibo	1.50	0.55	4.00	2.20	1.10	2.50	1.20	1.12	2.10	2.00	8.00	3.00
Barros				0.11	3.50	0.80	5.80	1.35	6.10	2.60	6.80	2.30
Bayamon	0.58	0.23	5.82	0.50	2.46	2.19	1.91	1.92	1.84	2.37	2.81	
Caguas	0.03				1.75	0.71	5.30		2.60	5.00	3.00	0.50
Canovanas	0.72	0.05	1.28	0.16	1.10	1.12	6.27	1.30	3.10	3.40	2.35	1.40
Cavey	1.27	0.33	1.44	0.47	1.12	4.27	4.52	1.45	6.47	1.70	7.65	0.92
Cidra	2.00	0.35	3.00	0.65	1.23	1.43	3.05	1.18	2.00	1.30	2.24	1.38
Corozal	2.20	2.10	2.30	1.90	1.90	1.22	2.30	1.94	1.98	1.86	3.80	3.40
Isabela	2.60	0.42	2.00	1.85	1.31	2.70	1.28	0.90	3.45	2.53	2.03	3.20
La Isolina	2.85	0.45	5.80	2.00	4.23	2.00	1.60	1.11	1.85	1.70	9.00	1.61
Manati	2.00	0.20	9.32	2.80	1.56	2.80	1.35	1.87	5.28	4.23		
Morovis	2.18	0.52	8.30	1.91	3.40	5.14	3.59	7.02	8.02	3.36	3.92	2.24
Perla	2.32	0.32	2.14	2.28	5.14	3.59	7.02	1.20	2.47	1.66	2.85	2.02
San Juan	1.38	0.42	2.08	0.51	1.49	0.96	4.04	3.10	2.47	1.66	2.85	2.02
San Lorenzo	2.00	0.44	4.14	0.29	1.75	2.00	3.01	1.38	4.13	4.54	5.00	1.49
San Salvador							1.50	3.60	1.45	9.90	2.00	4.08
Utuado	1.42	0.23	5.62	2.95	3.65	1.27	2.04	2.26	8.50	4.55	6.40	1.80
<i>East side.</i>												
Fajardo	3.76	0.62	1.41	0.87	1.68	1.92	7.62	1.24	6.48	1.97	4.05	2.48
Humacao	2.00	0.05	1.37	0.86	3.01	2.20	5.50	1.40	3.30	2.70	3.60	1.50
Maunabo	2.00	0.70	1.21	0.80	7.30		2.34	1.60	2.50	1.95	2.30	2.00
<i>South side.</i>												
Aguirre												
Coamo	0.52	0.25	0.44	0.70	0.82	2.90	1.55	2.25	1.89	1.58		
Guayama	8.10	1.40	0.70	1.05	1.85	1.05	4.13	1.23	5.05	1.90		5.00
Juana Diaz										1.85	1.39	1.27
Ponce	2.00	0.23	0.58	1.00	1.04	0.46			3.30	0.90	3.50	0.52
Santa Isabel	0.58	0.55	0.25	0.17	0.52	0.30	2.45	0.68	2.03			0.92
Yauco	0.84	1.05	1.20	0.27	1.05	0.30	2.02	1.30	2.70	1.00	1.77	0.74
<i>West side.</i>												
Aguadilla	1.53	0.54	2.10	2.01	2.00						2.00	1.12
Amistad	0.98	0.67</										

TABLE 16.—*The greatest daily rainfalls, in inches—Continued.*

Year and station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
<b>1902.</b>												
<i>North side—Continued.</i>												
San Lorenzo .....	0.48	0.13	0.89	1.05	2.42	5.55	1.48	1.25	5.30	0.60	.....	2.00
San Salvador .....	1.80	0.22	0.57	2.00	2.97	2.07	1.65	1.45	2.50	1.08	2.70	2.70
Utuado .....	2.75	0.80	0.50	2.83	2.35	2.75	2.68	0.90	1.77	2.07	3.40	0.85
<i>East side.</i>												
Fajardo .....	1.70	0.05	0.82	1.50	2.25	3.95	0.66	0.83	2.30	0.70	1.45	0.72
Humacao .....	1.90	0.30	1.40	2.00	6.01	4.01	0.90	1.84	2.54	1.03	2.00	1.11
Maunabo .....	1.40	1.10	1.23	2.54	2.70	4.25	1.30	0.85	2.60	1.67	2.32	0.60
<i>South side.</i>												
Aguirre .....	0.74	0.06	0.29	1.32	1.05	4.50	0.23	1.09	0.85	2.58	1.43	0.95
Coamo .....	0.29	0.30	1.45	2.10	3.00	0.90	2.50	0.20	1.00	1.75	.....	.....
Guayama .....	0.67	0.18	0.23	1.76	0.95	6.40	0.28	1.27	1.57	1.83	3.90	0.35
Juana Diaz .....	0.50	0.21	0.19	1.49	1.87	4.00	0.50	.....	1.47	1.41	0.52	.....
Ponce .....	0.45	1.	0.07	1.80	1.95	2.50	0.40	0.95	1.10	1.76	0.31	1.30
Santa Isabel .....	0.71	0.17	0.12	1.79	1.30	3.40	0.11	0.80	0.95	2.23	1.35	2.44
Yauco .....	0.50	0.07	0.30	1.97	1.80	2.60	.....	1.80	2.30	0.60	1.35	0.87
<i>West side.</i>												
Aguadilla .....	2.44	0.72	0.23	1.22	1.28	3.60	0.84	2.70	1.41	1.72	2.22	1.38
Amistad .....	.....	.....	1.56	1.56	2.00	0.71	0.97	0.82	0.84	1.64	1.81	.....
Coloso .....	2.00	0.11	0.22	0.95	1.92	2.32	0.98	0.94	2.09	1.33	1.83	0.64
Las Marias .....	0.79	0.20	0.78	2.26	3.76	1.65	1.83	2.11	3.70	2.95	2.42	2.41
Mayaguez .....	1.21	0.30	0.06	4.07	4.06	4.05	1.50	1.98	4.07	1.00	1.48	1.16
San German .....	.....	0.05	0.53	2.20	2.84	1.33	1.86	3.69	1.30	1.05	2.40	2.00
<b>1903.</b>												
<i>North side.</i>												
Adjuntas .....	1.81	0.24	0.62	1.10	2.21	0.90	1.72	1.60	1.00	2.90	4.60	1.90
Arecibo .....	0.40	0.40	1.70	0.00	4.00	0.90	0.85	1.00	1.70	1.30	1.50	2.35
Barros .....	0.10	1.00	0.80	4.15	2.16	0.03	1.10	1.40	2.35	2.05	2.51	4.04
Bayamon .....	0.19	0.20	0.45	0.87	2.00	0.70	0.60	0.70	0.60	0.95	0.60	1.00
Caguas .....	0.60	0.30	0.20	2.17	1.27	1.75	0.90	4.00	0.62	3.32	1.50	0.86
Canóvanas .....	0.40	0.30	0.27	1.10	0.24	0.95	2.03	5.29	1.64	2.05	1.75	6.40
Cayey .....	0.30	0.52	0.22	0.90	0.15	1.90	2.18	3.80	2.10	2.31	2.60	0.84
Cidra .....	0.60	0.08	1.90	1.80	0.90	0.80	2.14	4.50	1.00	1.30	0.60	4.00
Corozal .....	0.15	1.10	0.86	2.80	2.40	0.80	1.59	.....	2.30	2.26	2.29	.....
Isabela .....	0.42	0.30	0.73	4.05	2.97	1.34	0.53	1.12	1.45	2.40	2.15	2.57
La Isolina .....	0.20	0.25	1.60	5.23	.....	3.03	1.32	2.32	2.57	1.90	3.30	2.84
Manati .....	0.27	0.24	0.62	3.10	1.30	1.10	1.11	1.45	1.45	2.32	2.60	2.98
Morovis .....	1.30	0.61	1.40	1.55	2.30	1.80	1.30	1.90	2.10	1.80	1.80	2.20
Perla .....	0.96	0.43	0.58	2.80	3.50	1.68	2.24	3.74	1.16	3.00	3.36	4.32
San Juan .....	0.73	0.42	1.29	0.90	1.80	0.66	1.25	3.00	1.16	1.79	1.55	4.50
San Lorenzo .....	0.43	0.50	0.51	0.91	2.10	1.50	1.50	3.10	1.23	2.05	2.17	1.42
San Salvador .....	0.13	0.40	0.55	2.10	3.70	1.77	0.87	2.60	3.09	1.65	4.00	3.40
Utuado .....	.....	0.20	1.25	2.05	5.20	3.05	2.00	4.00	2.75	1.20	5.60	3.00
<i>East side.</i>												
Fajardo .....	0.47	0.30	0.45	0.78	2.05	1.12	2.03	2.47	0.57	2.90	1.40	2.05
Humacao .....	1.00	1.30	0.17	1.10	2.30	1.50	0.90	2.25	0.99	1.50	1.60	1.65
Maunabo .....	0.83	0.90	0.40	0.45	1.55	1.50	2.60	2.10	1.10	2.60	1.80	1.00
<i>South side.</i>												
Aguirre .....	0.22	0.20	0.24	0.52	0.96	1.57	2.69	3.72	0.65	3.00	1.03	0.30
Coamo .....	0.01	0.01	0.01	0.65	1.30	2.80	1.50	1.15	1.90	1.95	1.01	.....
Guayama .....	0.24	.....	0.58	0.45	0.65	2.85	3.10	1.97	1.65	3.31	2.01	0.60
Juana Diaz .....	0.15	0.65	0.77	0.46	3.30	1.53	.....	.....	.....	.....	.....	.....
Ponce .....	0.54	0.16	0.40	0.45	0.67	1.66	2.11	2.07	2.25	2.30	0.90	.....
Santa Isabel .....	0.07	0.12	0.30	0.75	1.45	0.58	3.40	1.20	0.63	2.80	4.00	0.23
Yauco .....	0.57	1.31	1.71	1.02	2.00	0.41	1.80	0.94	0.69	2.45	2.46	0.94
<i>West side.</i>												
Coloso .....	.....	0.50	1.36	1.95	1.50	2.25	2.30	0.99	2.03	2.50	2.00	1.83
Las Marias .....	0.54	0.14	0.90	2.50	1.95	2.10	.....	2.22	3.27	2.85	2.49	1.55
Mayaguez .....	1.51	0.20	1.03	0.77	2.84	2.90	1.86	1.93	1.84	1.67	3.63	1.26
San German .....	0.30	0.66	0.67	1.78	1.42	3.55	1.10	2.33	1.20	3.05	5.75	1.05
<b>1904.</b>												
<i>North side.</i>												
Adjuntas .....	1.15	0.60	2.50	2.10	0.60	0.62	1.06	2.55	1.73	1.75	2.30	0.45
Arecibo .....	0.45	2.70	1.00	1.70	0.80	0.70	0.80	0.80	1.60	0.81	0.70	1.10
Barros .....	3.58	2.00	2.35	1.45	0.40	.....	.....	1.60	1.45	1.20	1.40	1.05
Bayamon .....	0.90	0.55	2.00	1.00	.....	.....	.....	.....	.....	.....	.....	.....
Caguas .....	0.71	1.30	1.05	2.00	0.67	1.00	1.00	0.90	0.60	1.98	1.95	0.64
Canóvanas .....	0.80	1.25	1.20	1.50	0.50	0.80	1.72	2.63	1.58	2.80	2.30	0.53
Cayey .....	1.05	1.15	2.10	1.40	0.47	2.15	4.20	1.10	.....	.....	.....	.....
Cidra .....	2.30	1.50	3.00	1.90	2.30	2.90	3.45	3.42	.....	.....	3.80	.....
Corozal .....	1.31	.....	.....	0.97	.....	.....	.....	0.95	0.90	1.20	0.55	.....
Isabela .....	0.70	2.94	1.18	2.37	2.09	0.93	0.38	0.57	1.75	1.20	3.70	1.00
La Isolina .....	0.77	3.40	2.28	2.27	1.04	2.50	1.60	1.18</td				

TABLE 16.—*The greatest daily rainfalls, in inches—Continued.*

Year and station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1905.												
<i>North side—Continued.</i>												
Capugas.....	1.02	0.50	1.36	0.35	1.00	2.00	4.30	1.30	2.30	1.40	0.80	2.00
Canóvanas.....	2.53	0.23	2.10	0.51	3.85	0.95	2.00	1.90	3.10	1.60	1.31	0.45
Cayey.....	2.50	0.37	...	0.40	0.86	0.35	3.18	1.86	1.42	4.10	1.72	0.48
Cidra.....	1.00	0.52	0.40	0.64	0.90	0.85	1.00	0.70	0.90	2.80	0.88	...
Corozal.....	1.00	0.60	1.50	0.70	1.83	0.83	0.48	1.10	1.56	1.25	1.80	...
Isabela.....	0.58	1.53	1.47	1.00	2.15	3.00	1.50	1.24	2.10	...	...	...
La Isolina.....	2.97	0.36	1.58	1.26	0.75	1.70	1.00	0.93	2.05	2.30	4.46	0.84
Manati.....	1.40	0.80	1.10	1.10	1.14	...	...	1.90	...	1.70	1.55	...
Morovis.....	2.29	0.72	1.01	0.53	1.37	0.78	3.01	1.80	2.90	2.78	1.97	0.91
San Juan.....	0.71	0.40	1.90	0.87	4.00	1.50	5.70	1.70	2.70	3.94	3.50	0.69
San Lorenzo.....	2.00	0.75	1.33	3.04	0.71	2.70	0.54	1.70	1.70	2.96	1.46	0.64
San Salvador.....	...	...	...	...	...	...	...	...	...	...	...	...
<i>East side.</i>												
Fajardo.....	1.95	0.63	1.45	0.50	3.38	0.80	1.05	3.38	1.60	3.67	1.90	0.85
Humacao.....	0.92	0.40	0.80	0.80	2.20	0.80	1.50	3.20	6.15	2.95	5.27	1.23
Maunabo.....	0.70	0.60	2.10	1.00	3.10	2.22	1.00	1.67	2.04	4.70	1.78	1.01
<i>South side.</i>												
Aguirre.....	0.49	0.22	1.40	1.06	0.47	5.96	2.90	1.26	3.54	3.63	1.89	0.76
Coamo.....	0.35	1.68	1.50	1.15	...	...	1.70	2.50	1.15	...	...	...
Guayama.....	0.60	0.20	1.10	1.70	0.98	3.07	2.05	0.85	2.09	3.24	1.24	0.83
Juana Diaz.....	T.	2.00	1.16	0.66	4.15	2.11	2.30	1.66	5.30	1.73	2.67	...
Ponce.....	0.05	0.01	...	0.54	...	...	2.08	1.77	1.42	0.67	0.36	...
Santa Isabel.....	1.06	0.20	0.95	1.56	1.00	3.20	2.50	0.87	2.19	3.50	1.54	0.43
Yauco.....	0.44	0.45	0.76	2.32	1.57	1.99	...	...	...	...	...	...
<i>West side.</i>												
Coloso.....	1.43	1.41	0.76	1.66	1.83	1.64	2.40	1.12	2.19	3.79	0.06	...
Las Marias.....	1.70*	2.20	1.37	1.52	2.64	1.68	3.60	2.06	2.40	2.90	0.54	...
Mayagüez.....	1.01	0.75	2.20	1.80	2.95	1.70	1.48	2.42	1.64	2.29	1.33	1.01
San German.....	0.70	0.80	0.90	1.84	1.32	2.50	0.60	1.28	2.50	4.00	1.70	0.70

NOTE: Letters indicate the number of days missing; for example, \* represents one day, † two days, etc.

\* Estimated.

† 7.30 inches measured; 4 inches additional estimated.

‡ Incomplete.

TABLE 17.—*The average wind movement, in miles, for each hour of 75th meridian time at San Juan, Porto Rico. The means for January to June, inclusive, are based upon a five-year record, January, 1899, to June, 1903; but those from July to December, inclusive, on a four-year record, July, 1899, to December, 1902. The yearly means are based upon a four-year record, 1899 to 1902. Data taken from records of United States Weather Bureau.*

Month.	0 to 1 a. m.	1 to 2 a. m.	2 to 3 a. m.	3 to 4 a. m.	4 to 5 a. m.	5 to 6 a. m.	6 to 7 a. m.	7 to 8 a. m.	8 to 9 a. m.	9 to 10 a. m.	10 to 11 a. m.	11 to 12 noon.	Noon to 1 p. m.	1 to 2 p. m.	2 to 3 p. m.	3 to 4 p. m.	4 to 5 p. m.	5 to 6 p. m.	6 to 7 p. m.	7 to 8 p. m.	8 to 9 p. m.	9 to 10 p. m.	10 to 11 p. m.	11 to mid.	For the month.
January.....	7.4	7.3	7.1	7.2	7.2	7.5	7.3	7.9	9.8	11.6	13.2	14.1	14.8	14.9	14.5	14.1	13.1	11.7	11.1	10.0	9.0	8.6	8.3	8.0	10.3
February.....	7.0	6.5	6.2	6.3	6.3	6.3	6.5	7.1	9.5	12.1	13.6	14.3	15.1	15.3	15.3	14.8	14.0	12.2	10.4	9.5	8.5	7.7	7.0	7.0	10.0
March.....	7.8	7.6	7.6	7.2	6.9	6.8	6.8	8.3	11.1	13.4	14.9	15.7	16.4	16.4	16.0	15.3	14.5	12.9	11.7	10.7	10.0	9.0	8.5	8.0	12.0
April.....	6.4	5.8	5.7	5.5	5.6	5.6	5.8	7.2	9.9	12.2	13.7	15.0	15.8	15.9	15.6	14.9	13.9	12.2	10.6	9.6	8.6	8.0	7.6	6.9	9.9
May.....	5.5	5.3	4.9	4.8	4.8	4.7	5.2	6.8	9.4	11.4	13.2	13.7	14.5	14.4	13.5	12.7	11.9	10.4	9.1	8.1	7.2	6.5	6.2	5.7	8.8
June.....	7.1	6.7	6.4	5.9	5.8	5.6	6.4	9.1	12.1	14.1	15.3	15.9	16.2	15.7	15.1	14.1	13.3	11.7	10.7	9.4	8.8	8.6	8.1	7.1	10.4
July.....	8.5	7.6	7.2	6.8	6.6	7.0	7.7	10.0	12.7	14.7	15.9	16.4	16.6	16.3	16.1	15.5	14.7	13.6	12.6	12.2	11.6	11.0	10.4	9.7	11.7
August.....	7.4	6.9	6.4	6.1	6.0	6.1	6.7	8.2	12.2	14.1	15.6	15.8	15.8	15.8	15.2	14.6	13.9	12.6	11.6	10.8	9.8	9.1	8.7	8.1	10.8
September.....	6.0	5.8	5.6	5.5	5.7	5.6	6.2	7.2	10.0	12.2	13.4	13.9	14.2	14.2	13.5	12.9	12.0	10.6	9.8	8.4	7.9	7.0	6.9	6.4	9.2
October.....	4.9	4.9	4.6	4.5	4.3	4.1	4.4	5.1	6.8	8.4	10.4	11.6	12.2	12.2	11.2	10.2	9.2	8.2	7.4	6.6	5.8	5.4	5.6	4.9	7.2
November.....	6.2	6.0	6.3	6.0	5.6	5.4	5.4	6.1	8.4	10.6	11.8	12.8	13.7	13.4	12.6	11.4	10.2	9.5	8.7	8.4	7.8	7.1	6.4	8.9	
December.....	7.2	7.2	7.2	7.0	6.8	6.7	6.6	7.2	9.3	11.5	12.7	13.3	14.0	14.0	13.7	13.3	12.4	11.2	10.2	9.5	8.4	7.7	7.6	7.2	9.6
Year.....	6.7	6.4	6.2	6.0	5.9	5.9	6.2	7.6	10.0	12.1	13.5	14.2	14.8	14.7	14.3	13.6	12.8	11.4	10.3	9.4	8.6	8.0	7.9	7.1	9.7

TABLE 18.—*Number of thunderstorms recorded at San Juan, Porto Rico, in each month during the years 1899 to 1905, inclusive.*

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1899.....	0	0	0	0	2	5	8	7	13	9	2	0	46
1900.....	0	0	0	4	4	4	9	8	7	11	3	0	50
1901.....	0	0	0	1	11	13	7	8	7	11	2	1	61
1902.....	1	0	0	1	14	9	8	6	7	7	5	4	62
1903.....	0	0	0	6	4	10	8	10	13	9	3	2	65
1904.....	0	1	2	4	3	3	8	8	6	1	4	0	40
1905.....	0	0	0	1	3	6	8	10	11	12	3	2	56</td

TABLE 20.—*Data relative to the principal rivers of Porto Rico.*

Name.	Approximate length. Miles.	Approximate area of catch- ment basin. Sq. miles.	Approximate average minimum dis- charge, per second.	Principal tributaries.	Cooperative stations situated in basin.
<i>North side.</i>					
Sabana.....	6.2	.....	.....	Perla, None, Canóvanas.	
Rio Grande.....	9.3	.....	.....	Caguas, San Lorenzo.	
Loiza.....	36.7	376	1,600	.....	Bayamon, Cidra, Cayey, Comerio, Aibonito, Morovis, Corozal, Manati, Barros, Arecibo, Utuado, La Isolina, San Salvador, Adjuntas.
Bayamon.....	29.4	114	.....	.....	
Rio de La Plata.....	44.0	256	230	.....	
Cibuco.....	15.6	.....	.....	.....	
Manati.....	30.1	283	.....	.....	
Arecibo.....	28.2	343	100	Tanamá,.....	
Camuy.....	19.3	.....	.....	.....	
Guajataca.....	18.4	.....	.....	.....	
<i>East side.</i>					
Fajardo.....	10.7	35	.....	Fajardo.	
Rio Blanco.....	10.0	34	.....	None.	
Humacao.....	9.8	.....	.....	Humacao.	
Guayanices.....	15.6	44	.....	None.	
<i>South side.</i>					
Patillas.....	8.7	.....	.....	None.	
Guamani.....	8.7	.....	.....	Guayama.	
Rio de la Lapa.....	10.1	71	.....	Salinas.	
Coamo.....	17.7	97	100	Coamo.	
Jacaguas.....	13.2	60	50	Garcia.....	Juana Diaz.
Portugues.....	13.7	.....	25	.....	Ponce.
Canas.....	12.2	.....	35	.....	None.
Tallaboa.....	11.1	38	.....	.....	None.
Duoy (Yauco).....	16.7	67	.....	.....	Yauco.
<i>West side.</i>					
Culebrinas.....	21.1	107	100	Prieto,.....	Coloso.
Añasco.....	35.1	194	1,000	.....	Las Marias.
Yagüez (or Mayagüez).....	9.1	.....	.....	.....	Mayagüez.
Guanajibos.....	24.0	135	.....	Rosario, Viejo, (Hoconuco). .....	San German.

## A NEW FORM OF PRECISION BAROGRAPH.

By C. F. MARVIN, Professor of Meteorology, U. S. Weather Bureau. Dated June 20, 1906.

Modern instrumental meteorology owes a distinct debt of obligation to Monsieur Jules Richard and his predecessors, the firm of Richard Freres, for their inventions of many forms of recording meteorological instruments. More than twenty years ago they put on the market simple and reliable forms of barographs and thermographs, at a time when simple and practical instruments of this kind for ordinary observatory use were scarcely known. These are now extensively used everywhere, and, in the meantime, have been followed by many other ingenious instruments.

Their latest accomplishment is a new type of the aneroid barograph in which the pressure of the air is balanced against a massive weight. The following translation of their own description of the instrument, which is shown imperfectly in fig. 1, fully explains its construction.

## BAROMÈTRE A POIDS.

*The weighted aneroid barometer.*

This recording barometer of precision and great sensitiveness is based upon the aneroid principle, that is to say, upon exhausted chambers compensated for temperature. The chambers, or cells, are separately exhausted and do not contain any spring within. They are screwed together, one above the other, and the one on top is provided with a massive ring fixed to a metallic frame which is secured to the case at its extremities, and at the same time sustains the recording system in such a manner that any yielding due to the pull of the weight can have no effect on the barometric trace.

The mass required to counterpoise the air pressure on one of the barometric chambers weighs 126 kilograms, and as the cells are joined together "in tandem" the same weight suffices to counterpoise all.

In the ordinary aneroid barometer the only element lacking stability is the spring. All the errors come from this source, for, with time and changes of temperature, its elasticity undergoes modification; it weakens little by little, and the barometer tends to rise, especially in the first days of its construction. By replacing the spring by a weight, one obtains an instrument which conserves its zero point and becomes a veritable standard, easy to transport, which is not true for the mercurial

barometer. To transport the weighted aneroid it is necessary only to unhook the weight, which can be replaced at destination without any difficulty.

Another advantage in the weighted aneroid is that it registers equally seismic shocks, as well as the slow variations of the intensity of gravity accompanying the phenomena of tides. By comparing the curves of a weighted aneroid with those of a spring aneroid at the same place and regulated in the same manner, one may find in the differences some indications of the variations in the intensity of gravity.

Seismic shocks are generally so instantaneous and so feeble that they pass unperceived. The weighted aneroid records the precise hour at which they occur and, in part, their intensity, without the need of special apparatus for this purpose, such as seismographs, which are so rarely called upon to perform their function in our locality that they are almost always not in operation.

The weighted aneroid is made in two models. The one represented in the cut herewith gives a deviation on the paper of 3 millimeters per millimeter of the mercurial barometer, and is provided with a cylinder of 125 millimeters diameter making one revolution per week. The second model is much more sensitive, that is, 10 millimeters it may be, or 20 millimeters, per millimeter of mercury, and has a cylinder 303 millimeters in diameter making one rotation per day. In an instrument of great sensibility it frequently happens that the pen passes beyond the margins of the record sheet, whereupon it becomes necessary to return the pen to the middle of the sheet in order to avoid interruption of the record. Generally this may be accomplished by hand, by operating a button for this purpose, but a model is made where this operation is effected automatically by the aid of an electric motor.

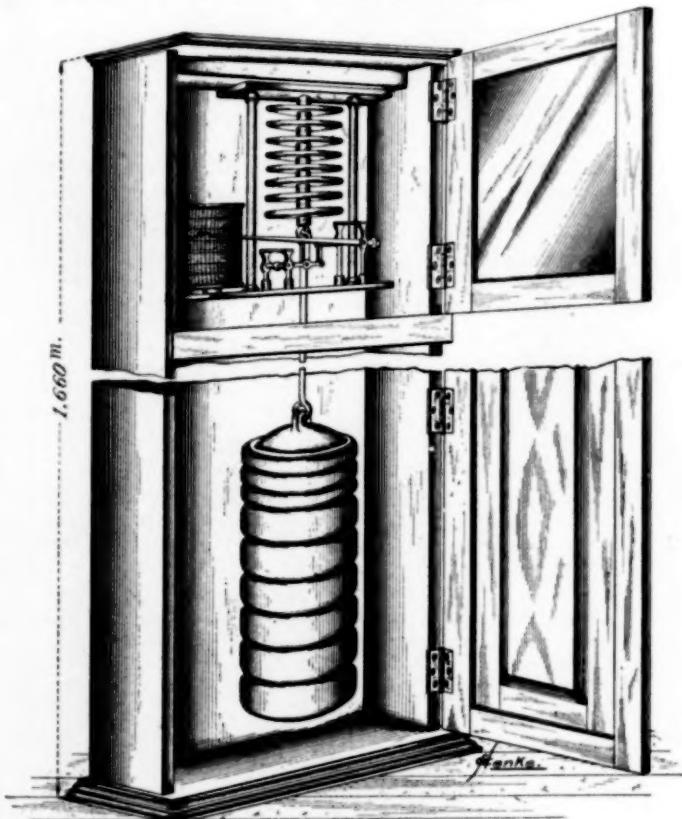


FIG. 1.—Weighted aneroid barograph. (Richard.)

The instrument thus described embodies a distinctly new departure in aneroid construction, and probably attains increased accuracy and constancy in barographs of this form. The writer is hardly prepared to admit, however, that variations in gravity can be satisfactorily shown by this instrument, or that "the only element lacking stability in aneroid barometers of the ordinary construction is the spring".

In discussing the irregular movements exhibited by aneroids the following statements were made by the writer in a previous publication:<sup>1</sup>

It seemed to me that the real seat of the greater part, if not all of the

<sup>1</sup> Monthly Weather Review, September, 1898. Vol. XXVI, p. 410.

after effect, or creeping, is in the corrugated aneroid vacuum boxes themselves, as distinguished from the tempered steel springs that are employed to keep the box from collapsing under the pressure of the air. This conviction was forced upon my mind after reading Mr. Whymper's valuable paper on the errors of the aneroid, and in 1892 I made the following simple experiment, which greatly confirmed this supposition: The vacuum box of an old aneroid was removed, and a heavy weight (a trifle over fifty pounds was required) was applied directly to the steel spring, thereby straining it as nearly as possible to the same extent as did the air pressure exerted through the medium of the corrugated vacuum box. Any desired changes in the position of the index were made by appropriate changes in the weight. No after effect comparable in magnitude with that exhibited by ordinary aneroids was ever observed. In other words, this tempered steel spring behaved to all intents and purposes as if it were a *perfectly* elastic body. Readings of the pressure scale could be made corresponding to about 0.005 of an inch on the barometer. A careful or full investigation was not attempted. I believe, nevertheless, that the tempered steel springs employed in all aneroids are, or may easily be made to be, highly trustworthy. On the other hand, the process of constructing the vacuum boxes is well calculated to develop therein irregular and imperfect elastic properties in the highest degree. The top and bottom surfaces are each formed of a thin circular sheet of metal, with a narrow rim bent up around the edge. In order to give flexibility, several concentric corrugations are formed over quite the whole face of the disk. The crimping and bending operations necessary in the manufacture of these corrugated disks have a marked effect upon the elastic qualities of the metal, which, to make matters worse, is generally of brass, german silver, or some similar alloy well known to be only imperfectly elastic under the most favorable conditions. The metal must originally be, more or less, in a soft and annealed condition in order to withstand the corrugating and bending operations. Those portions which are stretched and compressed by the process become stiffer and more elastic, and a most complex and irregular system of internal stresses and strains exists within the finished disk. The arrangement of molecules is undoubtedly a highly unstable one, and it is not surprising that large, discontinuous, and unexpected changes take place in the readings of the finished instrument.

A careful examination of the theory of the weighted aneroid will show that the massive weight does not counterpoise all the air pressure upon the vacuum chambers. These latter, of themselves, offer an additional elastic reaction which increases in amount with greater distension and diminishes as the chambers close together. The fixed, invariable, weight of the suspended mass can exactly counterpoise the air pressure on the cells for only one particular barometric pressure. A greater pressure will lift the weight and a lower pressure would permit it to fall by an indefinite amount, if the elastic restraint of the chambers themselves, or some equivalent effect,<sup>2</sup> does not operate to counterbalance the excess or deficit in pressure and thus establish a system which is in stable equilibrium.

We find, therefore, that in this weighted aneroid the real variations in air pressure are measured and registered entirely by the elastic reactions and deformations going on in the material of the vacuum chambers themselves. It is quite certain that the elastic properties of the chambers can not be so nearly perfect as those of finely tempered steel springs, and the writer is compelled to conclude that the barometric records by means of the weighted aneroids will still be found subject to appreciable, if not serious, errors of the kind so characteristic of all aneroids yet employed.

#### SNOW ROLLERS.

By MR. WILSON A. BENTLEY. Dated Jericho, Vt., June 26 and July 5, 1906.

During the night of January 18, 1906, there occurred at and in the vicinity of Jericho, Vt., the very interesting and somewhat rare phenomenon of the formation by wind action of vast numbers of snowballs, or snow "rolls" or "rollers". A brief account of them, and of the weather conditions that prevailed before and while they were being formed, may possibly be of interest to the readers of the WEATHER REVIEW.

About five inches of very light, fluffy snow fell during the

<sup>2</sup> An automatic variation of the area upon which the air pressure is operative would be perhaps an ideal way to attain the desired end provided no frictions or elastic reactions were involved, but nothing of this character is comprised in the present instrument.

twenty-four hours immediately preceding the phenomenon. During this time the temperature ranged from 14° to 22° F. But during the night of the 18th, when the snow rolls were formed, the temperature slowly rose from 24° to 34° F., and the lower wind shifted from westerly to southerly points and blew at times in a very strong but intermittent and peculiar gust-like manner. The snow rolls were formed during the latter part of the night, after the rise to 34° was accomplished. This rise in temperature operated to cause a slight superficial melting of the upper layers of the snow and to make it slightly damp, so that the individual snow crystals tended to cling to one another.

So far as the writer was able to observe, and to learn from others in adjoining towns, the phenomenon occurred only over a quite limited and narrow strip of foothill country perhaps one mile wide, lying alongside and parallel to, but at a little distance from, the western side of the Green Mountains. The winds that produced the phenomenon blew across the valleys and foothills rather than parallel to their greater length. The topography of the region in question is such as to cause the winds that reach the valleys, or at least some of them, to flow or pour downward into them in descending order from foothills of considerable height.

In many cases the gusts of wind evidently had a strong descending motion, such as just described, for they actually scooped up considerable masses of the light, damp, fluffy snow and formed it into ridges or hollow snow arches, and rolled many of these up into snow rolls of various sizes.

The forms and structures of the snow rolls were such as to indicate that, at least in many cases, the wind that scooped up the fluffy snow masses into ridges or open arches, got in behind such ridges and arches (which may be termed "cores") and blew them over upon themselves or upon the snow directly in front and to the leeward of them, thereby imparting both rotary and forward motions to the snow core ridges or arches, blowing and rolling them along in this manner for some distance. Fresh layers of damp surface snow collected upon them as they rolled along upon the surface of the snow, and operated rapidly to increase their size and specific gravity. Eventually the rolls became so large and heavy that the winds were unable to roll them farther and they came to rest. Variations in exposure to winds and surface topography operated to cause some rolls to be blown along much farther than were others, hence some became of much greater size and weight than others. The individual snow rolls varied in size one with another, from tiny rolls but a few inches in diameter to huge ones 18 by 24 inches in size. In most cases the diameters of the rolls were much less than were their lengths.

Perhaps the most interesting rolls thus scooped up and modeled by wind action were those whose "cores" were of an open, hollow character. Such came into existence in the form of hollow snow arches, as previously described, and were so substantial, or were rolled along so gently by the winds, that their hollow cores were preserved intact, i. e., were not filled in as a result of collapse or of their rotary experiences. Figs. 1 and 2 show snow rolls of this character.

Unfortunately, the day following the formation of the snow rolls was a dark, cloudy day, unfavorable for photographic work, hence our original photographs of the snow rolls failed to show them with sufficient plainness, and it became necessary to increase their sharpness by recopying so as to produce extreme contrast effects. This explains why the trees, etc., show up so very darkly in these photographic prints.

The wind came from the right-hand side of these figs. 1 and 2. They show the paths of some of the rollers, and their beginnings on the right-hand side. The accumulation of snow occurring on the right-hand, or windward, side of each roller was, I am certain, not blown there from a distance by the wind,

but is, in each case, a partly detached layer of snow, that adhered to and was partly lifted up by the roll while that was revolving, but that settled back to earth at a later time, owing to the continuation of the process of partial melting that was going on at a temperature of  $34^{\circ}$  to  $36^{\circ}$  F. In case the roller had undergone another revolution such windward layer would doubtless have gone with it, and been incorporated within the mass. Many of the rollers formed on a practically level surface, and some were actually rolled up a slight incline.



FIG. 1.—Snow rollers at Jericho, Vt.



FIG. 2.—Snow rollers at Jericho, Vt.

**SNOW ROLLERS AT MOUNT PLEASANT, MICH.**  
By Prof. R. D. CALKINS. Dated Central State Normal School, Mount Pleasant, Mich., June 27, 1906.

On the evening of January 17 [1906], the wind at Mount Pleasant, Mich., was northeast, and a light flaky snow was falling. During the night the wind backed through north and

northwest to the southwest. In the morning we found that at the northwest corner of the Normal School Building snowballs, or snow rolls, to the number of fifty or seventy-five had been formed. They varied in size from three inches in diameter to twelve inches. They were rolls of snow rather than snowballs, for most of them had square ends. They were spiral in structure when viewed from the end. Behind each roll was a path where the snow had been taken up, and the depth of snow removed from this path corresponded very closely to the thickness of the layers forming the roll. These paths became narrower as the corner of the building was approached, where they all disappeared, as indicated in the diagram, fig. 1. The rolls were very light and would hardly hold together sufficiently to preserve their shape when lifted. Some boys from the country on the same morning reported similar balls two feet in diameter. The wind has a long, unobstructed sweep from the southwest. There were no tracks of children about the balls, and there can be no doubt that they were wind-formed. Can you give me any more information concerning the origin of such balls or rolls? Just why, and how, do they start?

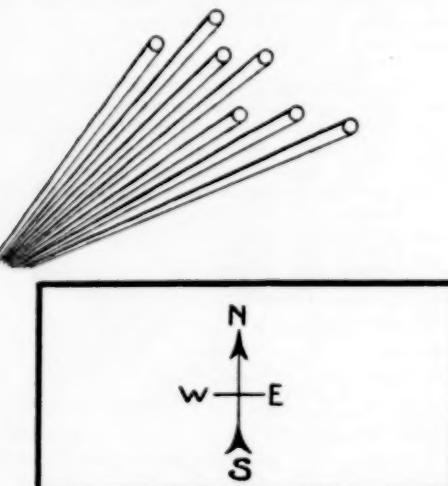


FIG. 1.—Paths of snow rollers at Mount Pleasant, Mich.

*Note.*—The initial step in the formation of snow rolls seems not yet to have been observed. They appear generally to be formed at nighttime, or in the very early morning, and the diagram by Professor Calkins suggests that they are formed by or among the eddies in the strong wind at the corner of a building or other obstacle.

We note that in the *Meteorologische Zeitschrift*, May, 1895, p. 198, Prof. K. R. Koch, of Stuttgart, mentions three ways in which snow becomes hardened after it has fallen:

1. A warm snowfall is followed by cold west winds that favor compression, the wind in descending gusts forcing or pressing it into a hard, solid mass.

2. Hard surfaces are formed by melting and freezing and become hard enough to support the mountain climbers in the Alps and Black Forest.

3. In March and April in the mountains, before thawing weather begins, the insolation is powerful, and snow crystals exposed in the sunshine are evaporated and the vapor is actually recrystallized; thus very large crystals are formed and the layers of snow become quite solid; it is not impossible that large nuclei may thus be formed.—C. A.

**MONTHLY REVIEW OF THE PROGRESS OF CLIMATOLOGY THROUGHOUT THE WORLD.**

By C. FITZHUGH TALMAN, U. S. Weather Bureau.

**THE ASIATIC RAILROADS AND THE PROGRESS OF METEOROLOGY.**

This is emphatically an era of railroad building throughout Asia. It may be but a few years before we witness in Asia a

sort of parallel to the most impressive geographical event of last year, which I take to have been the journey of the members of the British Association, by rail, from Capetown to the Zambesi. One of these days the same body will assemble in the Indian Empire, journey over the railroads now existing to Darjiling, and there board a specially chartered train of the "Trans-Tibetan" or the "Asia Central" for some point or other in the Chinese Delta.

Then, perhaps, we shall have, from the entertaining pen of Dr. Hugh Robert Mill, "Central Asia as seen by a meteorologist", illustrated with photographs of the meteorological observatories of Lassa (central office of the Pontifical Tibetan Weather Service) and Singan-fu.<sup>1</sup>

While statesmen are concerned with the political advantages to be derived from the new iron highways into the Asiatic interior, and while the commercial world is counting the material gains sure to accrue from the opening of new countries to trade, the meteorologist may be pardoned for indulging in a little jubilation on his own account, as he beholds the region over which the phenomena of the atmospheric circulation assume grander proportions than anywhere else upon the globe brought more and more fully within the field of his observation. The time can not be far distant, unless wholly improbable circumstances should check the present tide of progress in the eastern world, when the scant and hasty meteorological gleanings of the geographical explorer will give place to data regularly supplied by well equipped observatories and flashed over the earth by wire (or wireless) for the benefit of the weather forecaster.

It is significant of the importance which forecasters, no less than climatologists, attach to the meteorology of Asia, as a preponderating factor in the meteorology of the Northern Hemisphere, that the Indian Meteorological Department has recently arranged to receive daily telegraphic reports from six Russian stations in Siberia, and that the United States Weather Bureau is even now negotiating with the Russian service for reports from the same region. The stations from which these reports will come lie to the north and west of the mean position of the great central Asian winter "high"—the area of greatest pressure observed upon the earth—whether we accept its location as shown on Buchan's charts, the more southerly position in the Russian Climatological Atlas, or the extreme westerly position<sup>2</sup> indicated by certain recent investigations.

While the indications of these outlying stations may suffice to give us a general notion of the pressure fluctuations from day to day, the absolute value of the pressure in this all-important anticyclone must remain a matter of considerable uncertainty until new stations are established, at known elevations, in the very heart of Asia. With the development of railroads in this region, the establishment of the desired stations will be a matter of easy accomplishment. Besides making the region easy of access to European observers, the building of railroads will entail leveling operations supplying the precise altitude data required for the reduction of the pressure to sea level.

Of the many railroad projects now on foot in Asia the one that appears to promise most for meteorology contemplates the building of a line up the Irtysh Valley from some point on the Trans-Siberian Railway to the Chinese town of Chuguchak, within the borders of Sungaria. This is the route by which the Russians are now planning to open Mongolia to their commerce, in lieu of the road which they proposed building

<sup>1</sup> Cf. Doctor Mill's delightful chat, "South Africa as seen by a meteorologist", in Quarterly Journal of the Royal Meteorological Society, July, 1906.

<sup>2</sup> With a center near Turfan, longitude 89° east, latitude 43° north, in Chinese Turkestan. See Comptes Rendus Acad. des Sciences, Paris, t. CXXVIII, No. 3 (January 16, 1899), p. 154.

over the old caravan route from Irkutsk to Peking, via Urga, and which was abandoned because of the political results of the Russo-Japanese war. Of but little less importance is the proposed railway across the Kirghiz steppe to Tashkent.

Many circumstances denote the beginning of a new and hopeful era in the meteorological exploration of Asia, but space permits us to mention only two—the abandonment by the Tibetans of the policy which excluded foreigners from their territory (the happy result of the British Mission of 1904), and the recent awakening of China to the advantages of western institutions, especially railroads and telegraphs; of the latter, China now has some 15,000 miles in operation.

The Anglo-Chinese treaty regarding Tibet, signed April 23, 1906, opens certain trade marts in Tibet to the commerce of India, authorizes the Indian government to connect these places with India by telegraph, and grants to the British preference in the matter of railway concessions.

#### DOCTOR KOSTLIVY ON THE CLIMATE OF BEIRUT.

Regierungsrat Stanislav Kostlivy, the veteran vice-director of the Austrian Centralanstalt für Meteorologie, who died October 7, 1905, left behind him, in the press, an elaborate and beautiful discussion of the meteorological observations at the Syrian Protestant College, Beirut, for the twenty-five years, 1876-1900.<sup>3</sup> This monograph is an excellent example of the painstaking methods of the Austrian climatologists, and is commended to the attention of anyone who contemplates writing an extensive discussion of the climate of a single station or small region. Beirut is one of the very few places in the Turkish Empire having a long unbroken meteorological record. The observations at the Syrian Protestant College, which is a purely American institution, have been published *in extenso* in the Jahrbücher of the K. k. Centralanstalt für Meteorologie, Vienna, since 1876.

Among the interesting facts brought out in the present discussion we notice that snow has never fallen in Beirut, though it sometimes falls on the nearby Lebanon and is not of very uncommon occurrence at Jerusalem, 150 miles farther south.

#### AUSTRALIAN HEAT VERSUS WHITE LABOR.

In the course of his Lake Eyre expedition of 1901-2, Dr. J. W. Gregory, of the University of Glasgow, was much impressed with the immunity with which white men pursue the most laborious occupations under the blazing sun of the Australian "back of beyond". His picture of the conditions of white labor in this part of the world is a genuine contribution to "anthropoclimatology":<sup>4</sup>

At Jibuti, in eastern tropical Africa, ten minutes' midday exposure without a hat is said to be inevitably fatal. But in Central Australia even newcomers like ourselves could go about hatless for longer periods without feeling any ill effects. We expected to find everyone hating the heat and devoting their utmost ingenuity to combat it. As the "terai" hats of tropical Africa and India are made of two layers, we expected to find at least a three-storied variety in use around Lake Eyre. Green umbrellas we thought would be man's constant companions, and after Sturt's experiences we should not have been surprised to find advertisements of inks guaranteed to remain liquid through a Central Australian summer, and pencils of plutonic graphite recommended for use in the Lake Eyre basin. (I have been seriously assured that Sturt could not keep a diary through the hot weather, as the heat softened the lead in his pencils.) But, on the contrary, the residents adopt no special precautions against heat. Our efforts to buy a sun umbrella were in vain; one storekeeper assured me that they were rarely used north of Adelaide. Houses are built of corrugated iron and not one in a dozen condescends to a veranda. \* \* \*

But in spite of the heat the people looked extremely well. The children were harder and less anemic than those at Adelaide. Doctor Kennedy assured me that there is no illness in the district, and that his post would be a sinecure were it not for ophthalmia and other ailments of the eyes. To my surprise we found men working in the open air at severe manual labor without adopting any precautions or special clothes. Simple slouch felt, or thin straw hats are generally worn, and our cook

<sup>3</sup> Kostlivy, Stanislav. *Untersuchungen über die klimatischen Verhältnisse von Beirut, Syrien.* Prag, 1905.

<sup>4</sup> Gregory, J. W. *The dead heart of Australia; a journey around Lake Eyre in the summer of 1901-2...* London, 1906.

defied the sun in a black hard felt "bowler"; yet notwithstanding the neglect of ordinary tropical precautions everyone looked in the best of health. The men are bronzed and tanned; but one is glad to miss the sallow complexions and wan faces that Europeans show in tropical African coast towns.

The tolerance of heat shown in this part of Australia certainly supports Sambon's theory in regard to acclimatization. Sambon holds that there is nothing to prevent Europeans living and working as well as any black race in the hottest of tropical localities. He maintains that the supposed unsuitability of the Tropics for European settlement is due to disease and not to climate, and that as the special tropical diseases are due to germs, they may be cured or prevented when the life histories of the germs are known.

Of course the climate of subtropical Australia, with its exceedingly low humidity (in the interior) and its wide annual range of temperature, is quite unlike that of those regions, such as West Africa and the Philippines, which have been especially under discussion in the recent voluminous literature for and against white colonization of the Tropics. It should be compared, rather, with the southwestern United States or northern Argentina, in which Europeans seem to thrive no less than in Australia. However, the problem of acclimatization is so important and is, moreover, so far from a satisfactory solution that all observations bearing upon it must command attention. In the present stage of investigation the difficulty seems to be to extricate the immediate effects of meteorological conditions upon man from those indirect influences which are exerted through the medium of disease germs, the latter finding some climates more favorable to their development than others. Doctor Sambon is one of those who hold that climate *per se* plays but an insignificant part in determining the health of our race.<sup>5</sup>

DOCTOR HELLMANN'S "PRECIPITATION IN THE NORTH GERMAN RIVER BASINS".<sup>6</sup>

The scope of this work is not fully indicated by its title. Among North German rivers Doctor Hellmann includes all the streams of Germany that discharge their waters into the Baltic and North seas. Consequently only one important river system of Germany, that of the Danube, is excluded from consideration in this treatise.

In three massive volumes the author has gathered together all material regarding the rainfall of the German river basins, with the exception above noted, available down to the close of 1890, the year in which this great work was begun. In the case of rivers that take their rise outside of Germany, the territory considered includes all the upper basin of the river, from its source; consequently a great wealth of data for Russia, Austria-Hungary, Switzerland, France, and Belgium is here presented, so that this work constitutes by far the most extensive compilation of rainfall statistics ever made. The total number of stations represented in the tables is 3983, of which 2220 lie within the German Empire.<sup>7</sup>

The data tabulated comprise, for all or a part of the stations: Monthly and annual rainfall for each year of observation; greatest daily rainfall in each month; number of days with a measurable amount of rain; number of days with more than 0.2 mm.; number of days with snow; dates of first and last snowfall; number of days with sleet and hail.

<sup>5</sup> See his paper, "Acclimatization of Europeans in tropical lands", in the Geographical Journal, December, 1898, p. 589, and the interesting discussion thereon. See also C. Abbe in "Liberia" 1892, Bulletin No. 1, pp. 34-40, American Colonization Society, November, 1892, "Climate and Health in Liberia".

<sup>6</sup> Hellmann, G. Die Niederschläge in den norddeutschen Stromgebieten. Berlin. 1906. 3 vols.

<sup>7</sup> The most extensive works of this character heretofore published are Wild's "Regenverhältnisse des Russischen Reiches" and Elliot's "Rainfall of India". The former comprises results from 451 stations; the latter, 456. Schott's rainfall tables for the United States include some 1200 stations, but give the records in much less detail than do the works above named. Supan's "Verteilung des Niederschlags", with 1223 stations, is a collection of normals only.

The average length of a record is seven and one-half years. The following stations, within the region under discussion, have records of fifty years or more (to and including 1890):

*In Germany.*—Königsberg, 51 y.; Tilsit, 71 y. 3 m.; Danzig, 57 y. 7 m.; Breslau, 54 y. 9 m.; Gütersloh, 53 y. 11 m.; Münster, 51 y. 11 m.; Bayreuth, 59 y. 10 m.; Dresden 58 y.; Freudenstadt, 56 y. 1 m.; Isny, 57 y. 9 m.; Stuttgart, 72 y. 1 m.; Arnstadt, 53 y. 5 m.; Bremen, 60 y. 6 m.; Lübeck, 50 y. 5 m.; Frankfurt a. M., 54 y. 3 m.

*In Russia.*—Warsaw, 84 y. 7 m.

*In Austria.*—Bodenbach, 55 y. 4 m.; Deutschbrod, 55 y. 8 m.; Lemberg, 56 y. 8 m.; Prague, 51 y. 5 m.

*In France.*—Nancy, 58 y.

Owing to the diversity in the lengths of the records and in the periods to which they refer, and to other circumstances that render the older records mutually incomparable, the data tabulated in this work have not been charted. Instead, a rainfall chart (for Germany only) has been made up from observations of some 3000 stations during the decade 1893-1902; during which time fairly uniform methods of observation were in vogue, and the short records were quite easily reduced to the full period. This chart shows that—

1. The rainfall of Germany decreases from west to east, both along the coast and in the interior.

2. The coastal plains have less rain than the interior.

3. The rainfall is remarkably dependent upon altitude, so that the rain chart indicates the relief of the country quite closely. Deeply shaded areas, denoting heavy rainfall, indicate the location of the important mountain ranges—Harz, Schwarzwald, Bavarian Alps, etc.—but many minor elevations are rendered conspicuous by the fact that relative altitude has more influence than absolute altitude in increasing the rainfall.

4. The effect of the prevailing westerly winds is clearly shown in the heavier rainfall on the west slopes of the mountains.

The first volume of Doctor Hellmann's work forms the text discussion of the results tabulated in volumes 2 and 3, and in it the student of rainfall will find much that is suggestive and of general application. The fluctuations in the rainfall of Germany and neighboring countries during the eighteenth and nineteenth centuries are fully treated.

From the many interesting contributions to climatology contained in this work we extract the following Table 1, showing the most remarkable cases of excessive rainfall, of at least one hour's duration, recorded within the German Empire:

TABLE 1.—*Excessive rainfall in Germany.*

Place.	Date.	Duration.	Amount.
Waltershausen, Saxony	Aug. 14, 1884	1 00	2.95
Neustadt-on-the-Hardt	Sept. 7, 1886	1 00	3.86
Schwerin, Mecklenburg	May 11, 1890	1 35	4.37
Bobersberg, Brandenburg	June 21, 1895	2 00	5.06
Wildgarten, West Prussia	Aug. 1, 1896	1 40	5.28
Kemnitz, Saxony <sup>8</sup>	July 17, 1887	2 00	5.90
Görlsdorf, Brandenburg	June 12, 1889	2 15	5.20
Berlin	Apr. 14, 1902	3 30	5.63

<sup>8</sup> A village near Neustadt. Not Chemnitz.

<sup>9</sup> Approximately.

#### PROGRESS OF METEOROLOGY IN AUSTRALIA.

By reading the dispatches from Melbourne, published in the Daily Telegraph, Sydney, N. S. W., June 16, 21, 22, 23, and 28, we see the progress being made toward the passage of the bill establishing a federal meteorological system for the whole of Australia. This bill was read for the first time in the Australian Senate on June 16; it makes provision for the appointment of a federal meteorologist, charged with the following duties:

- (1) The taking and recording of meteorological observations.
- (2) Forecasting of weather.
- (3) Issue of storm warnings.
- (4) Display of weather and flood signals.
- (5) Display of frost and cold-wave signals.
- (6) Distributing meteorological information.
- (7) Other prescribed duties.

On the 21st of June the "meteorological bill" passed to the second reading. It seemed to be in charge of Senator Keating, who said the object of the measure is to federalize meteorological observatory work; that the state governments and interstate conferences showed a general consensus of opinion in favor of a central weather bureau, but there was a difference of opinion as to federalizing astronomical work.

June 22 the debate was resumed, and the question was discussed as to the relative advantages of one commonwealth department controlling all meteorological work, or one federal officer who would have no power unless six state departments chose to work harmoniously with him. The bill was then referred back to the committee, where Senator Givens moved that the federal officer must have been a resident of Australia for at least five years; but this amendment was negatived after Senator Keating had denied that the federal cabinet intended to import and appoint a foreign meteorologist.

The bill came up for a third reading on June 23, and then came before the house of representatives on the 28th, on which occasion, in answer to a query, it was stated that the present bill only provided that the federal government should take over the meteorological departments from the states, and not the astronomical work; and that some of the states were strongly of the opinion that this latter should be done.

From later Australian papers of July and August we obtain the following items. According to the Sydney Morning Herald of July 2:

The Minister of Home Affairs in the Federal Government moved the second reading of the bill before the House of Representatives, and explained the advantages that would be secured by the proposed reorganization. One member said that astronomical observatories should be reorganized on the same plan, but the motion for the second reading was agreed to, without amendments or instructions, and the bill referred back to committee. In committee it was stated that the cost of weather telegrams would be 40,000 and the additional expenditures 10,000 pounds sterling annually. A new clause was inserted, enabling arrangements to be entered into with other countries for the interchange of meteorological information. The committee then referred the bill back to the House for its third reading. The House, by 31 votes to 8, negatived the motion that a clause should be inserted providing for the taking over of the state astronomical departments by the Commonwealth. The bill was then read a third time and passed.

On August 3 the Daily Telegraph states:

Now that the Meteorology Bill has practically become a law the Minister of Home Affairs is taking steps to organize a Federal Bureau. Apparently the United States methods will be followed as far as practicable, and when the system of wireless telegraphy is adopted by the Commonwealth a number of outlying observatory stations will be fitted up, so that daily reports can be sent.

It is eminently proper to congratulate our Australian colleagues on the prospect that now opens up before them of being able to organize not only an Australian but an Australasian service, that shall fill up the great gap between the Indian Ocean on the west and South America on the east, between the Antarctic Continent on the south and the equator on the north. This immense region, covering one-fourth of the globe, belongs peculiarly to Australia, and must be conquered meteorologically by Australasian energy and science. Some such movement has been longed for and hoped for since 1873, and it gives us the greatest pleasure to see this beginning of the realization of our hopes.

#### GEORGE J. HECK.

Through the death of Assistant Observer George J. Heck, which occurred at Williston, N. Dak., on July 4, 1906, the Weather Bureau suffered the loss of a kind and genial personality and the services of a conscientious, careful worker. Mr. Heck was connected with the Government Meteorological Service more than twenty years, and commanded the respect and esteem of all his associates. His devotion to his official duties was marked. Even when stricken with a fatal malady, he insisted upon taking the regular observations, typifying to the last the guiding principle of his life. The memory of his sterling qualities will abide with those who knew him.—D. J. C.

#### PHYSICAL SOCIETIES AND JOURNALS.

Under the above heading, in the MONTHLY WEATHER REVIEW for November, 1905, Volume XXXIII, page 490, we have urged those interested in the physics of the atmosphere to keep in close touch with the progress of our knowledge in physics by joining some one of the prominent physical societies, or otherwise subscribing for their periodicals. The short list of journals published at that time unfortunately omitted the well-known Belgian journal, *Ciel et Terre*, which is now in its twenty-eighth year, and is devoted to meteorology, astronomy, and magnetism. We have, therefore, compiled the following general list of periodical publications, most of them journals of societies devoted, at least in part, to the physics of the atmosphere, although a few of them bear more especially on climatology; all of them are, we believe, easily procurable by individuals and should be in every good scientific library:

#### AUSTRIA-HUNGARY.

Mitteilungen aus dem Gebiete des Seewesens. M. 8°. Pola. Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. M. 8°. Wien.

#### BELGIUM.

Bulletin de la Société belge d'Astronomie. M. 4°. Bruxelles. Ciel et Terre. S-m. 8°. Bruxelles.

Revue Néphologique. M. 8°. Mons.

#### ENGLAND.

Aeronautical Journal. Q. 4°. London.

Geographical Journal. M. 8°. London.

Journal Manchester Geographical Society. S-a. 8°. Manchester.

Knowledge. M. 4°. London.

London, Edinburgh, and Dublin Philosophical Magazine. M. 8°. London.

Nature. W. 4°. London.

Philosophical Transactions of the Royal Society. I. f°. London.

Proceedings Royal Institution Great Britain. I. 8°. London.

Proceedings of the Royal Society. Series A, Mathematical and Physical. I. 4°. London.

Quarterly Journal of the Royal Meteorological Society. Q. 4°. London.

Science Abstracts. M. 8°. London.

Symons's Meteorological Magazine. M. 8°. London.

#### FRANCE.

Aérophile. M. 4°. Paris.

Annales de Géographie. B-m. 8°. Paris.

Annuaire de la Société Météorologique de France. M. 8°. Paris.

Comptes rendus hebdomadaires des séances. Académie des Sciences. W. 4°. Paris.

Journal de Physique. M. 4°. Paris.

Nature. W. 4°. Paris.

## GERMANY.

Annalen der Hydrographie und Maritimen Meteorologie. M. 4°. Berlin.

Annalen der Physik. M. 8°. Berlin.

Aus dem Archiv der deutschen Seewarte. I. f°. Hamburg. Beiblätter zu den Annalen der Physik. S-m. 8°. Berlin. Beiträge zur Geophysik. Y. 8°. Stuttgart.

Beiträge zur Physik der freien Atmosphäre. Q. 4°. Strassburg.

Gaea. M. 8°. Leipzig.

Geographische Zeitschrift. M. 8°. Leipzig.

Halbmonatliches Literaturverzeichnis der Fortschritte der Physik. S-m. 8°. Braunschweig.

Himmel und Erde. M. 8°. Berlin.

Illustrierte aeronautische Mitteilungen. M. 4°. Strassburg.

Meteorologische Zeitschrift. M. 4°. Braunschweig.

Petermanns Mitteilungen. M. 4°. Gotha.

Physikalische Zeitschrift. S-m. 4°. Leipzig.

Weltall. M. 4°. Berlin.

Zeitschrift der Gesellschaft für Erdkunde. S-m. 4°. Berlin.

## INDIA.

Indian Meteorological Memoirs. I. f°. Calcutta.

## ITALY.

Bollettino bimensuale. Società Meteorologica Italiana. B-m. 4°. Turin.

## JAPAN.

Journal of the Meteorological Society of Japan. M. 8°. Tokyo. [Papers in Japanese; sometimes English, French, etc.]

## MEXICO.

Boletin Instituto científico y literario "Porfirio Diaz". M. 8°. Toluca.

## NETHERLANDS.

Hemel en Dampkring. M. 8°. The Hague.

Mededeelingen en Verhangelingen. Koninklijk Nederlandsch Meteorologisch Institut. I. 8°. Utrecht.

## SCOTLAND.

Journal of the Scottish Meteorological Society. Y. 4°. Edinburgh.

Scottish Geographical Magazine. M. 8°. Edinburgh.

## SWITZERLAND.

Archives des Sciences Physiques et Naturelles. M. 8°. Genève.

## UNITED STATES.

American Journal of Science. M. 8°. New Haven.

Astrophysical Journal. M. 4°. Chicago.

Bulletin American Geographical Society. M. 8°. New York.

Bulletin Geographical Society of Philadelphia. M. 8°. Philadelphia.

Experiment Station Record. U. S. Department of Agriculture. M. 8°. Washington.

Journal of the Franklin Institute. M. 8°. Philadelphia.

Journal of Geography. M. 8°. New York.

Monthly Weather Review. M. 4°. Washington.

National Geographic Magazine. M. 8°. Washington.

Physical Review. M. 8°. Ithaca.

Proceedings American Academy of Arts and Sciences. I. 8°. Boston.

Proceedings American Philosophical Society. I. 8°. Philadelphia.

Science. W. 4°. New York.

Scientific American and Supplement. New York. W. f°.

Terrestrial Magnetism and Atmospheric Electricity. Baltimore. M. 8°.

Water supply and Irrigation Papers. U. S. Geological Survey. I. 8°. Washington.

In addition to the above we note that every large library receives the volumes of the International Catalogue of Scien-

tific Literature, which has been published for the past four years under the auspices of the Royal Society in London. Part F, which refers especially to meteorology and climatology, will always be found useful for reference, if one wishes to consult the latest memoirs on any special question in meteorology.

NOTE.—M. monthly. W. weekly. Q. quarterly. S-m. semi-monthly. B-m. bi-monthly. Y. yearly. S-a. semi-annually. D. daily. I. irregular intervals. f. folio.

## RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

C. FITZHUGH TALMAN, Acting Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

## Augustin, Fr[antisek].

Autografické záznamy tlaku, teploty, směru a rychlosti větru na rozhledně na Petřině na Praze R. 1895. (Rozpravy České Akademie císaře Františka Josefa pro vědy. Ročník V. Trída II. Číslo 16.) 85 pp. 4°. Praze. 1896.

Same. 1896. (Rozpravy České Akademie císaře Františka Josefa pro vědy. Ročník VI. Trída II. Číslo 22.) 86 pp. 4°. Praze. [1897.]

Meteorologická pozorování z rozhledny na Petřině v Praze 1894-1897, 1899-1905. 4°. [Praze.] n. d.

Záznamy autografických přístrojů na rozhledně na Petřině v Praze od R. 1897-1900. 41 pp. 4°. Praze. 1902.

## Austria. K. k. Zentral-Anstalt für Meteorologie und Geodynamik.

Jahrbuch. 1904 [and] Anhang. 4°. Wien. 1906.

## Belohlav, Josef.

Seznam prací, pojednání a článku, jež napsal Prof. Dr. František Augustin. [Catalogue of meteorological writings of Prof. F. Augustin.] 19 pp. 8°. Praha. 1906.

## Bulgaria. Institut Météorologique Central.

Tremblements de terre en Bulgarie. No. 6. Liste des tremblements de terre observés pendant l'année 1905. 142 pp. 8°. Sofia. 1906.

## Colegio de Belen. Observatorio.

Observaciones. 1905. v. p. f°. Habana. 1906.

## Ekholm, Nils.

Stormvarningar på Sveriges västkust. (Sveriges Allmänna Sjöfartsföreningens Tidskrift. 4 årgången. 1906. Fp. 50-67.) 8°.

## France. Service Hydrométrique du bassin de la Seine.

Observations sur les cours d'eau et la pluie . . . 1904. 7 sheets, 43 by 56 cm. n. t. p. Résumé. 1904. 22 pp. f°. Paris. 1905.

## Great Britain. Board of Trade.

Statistical tables relating to the British colonies, possessions, and protectorates, 1903. xiii, 876 pp. f°. London. 1905.

## Great Britain. Meteorological Office.

A barometer manual for the use of seamen. 45 pp. 8°. London. 1905.

Hourly readings . . . at four observatories in connection with the Meteorological Office, 1903. xiii, 197 pp. f°. London. 1906.

Meteorological observations at stations of the second order, 1901. xiv, 179 pp. f°. Edinburgh. 1906.

## Great Britain. National Physical Laboratory.

Report of the Observatory department. 1905. 43 pp. 4°. Teddington. 1906.

## Great Britain. Royal Observatory, Greenwich.

Results of the magnetical and meteorological observations, 1904. f°. Edinburgh. 1905.

Results of measures . . . of photographs of the sun, 1904. f°. xii, 97 pp. Edinburgh. 1906.

## Hellmann, G[ustav].

Die Niederschläge in den norddeutschen Stromgebieten. 3 vols. 4°. Berlin. 1906.

## International Latitude Observatory of Mizusawa.

Annual report of the meteorological and seismological observations, 1905. 13 pp. 4°. [Mizusawa.] 1906.

## Kuznetsov, V. V.

[Apparatus for determination of direction and relative velocity of motion of clouds.] [Russian title and text.] (Bull. Ac. sc. St. Petersburg. 1904. T. 21, No. 5.) Pp. 251-267. f°. St. Petersburg. 1905.

## Lamprecht, Guido.

Wetter-Kalender. 38 pp. 12°. Bautzen. 1905.

## Liverpool Observatory.

Report of the Director to the Marine Committee. 1905. 41 pp. 8°. Liverpool. 1906.

**Marriott, William.**

Some facts about the weather. 32 pp. 8°. London. 1906.

**Naturforschender Verein in Brünn.**

Verhandlungen . . . 1904. (47), 276 pp. 8°. Brünn. 1905.

**Naturforschender Verein in Brünn. Meteorologische Commission.**

23 Bericht . . . 1903. xv, 169 pp. 8°. Brünn. 1905.

**Nell, Chr. A. C.**

Uitkomsten der waarnemingen omtrent poolbanden, van 1874 tot 1894 hoofdzakelijk te Groningen en te Oosterbeek (bij Arnhem) verricht door H. I. H. Groneman, bewerkt door . . . (Overgedrukt uit "Hemel en Dampkring". 3e jaargang, 1906.) 17 pp. 8°. n. t. p.

**Norway. Norske Meteorologiske Institut.**

Jahrbuch . . . 1905. xlii, 120 pp. 8°. Kristiania. 1906.

**Paulsen, Adam.**

Sur les récentes théories de l'aurore polaire . . . (Oversigt Kgl. Danske vid. selsk. forhandl. Kjöbenhavn. 1906. No. 2.) Pp. 109-144. 8°. n. t. p.

**Philippine Islands. Weather Bureau.**

Annual Report of the Director . . . 1903. Pt. 3. 1128 pp. 4°. Manila. 1905.

**Physikalischer Verein zu Frankfurt am Main.**

Jahresbericht. 1904-1905. 106 pp. 8°. Frankfurt am Main. 1906.

**Russia. Central Physical Observatory.**Annales. 1903. 1<sup>er</sup> et 2<sup>me</sup> parties. 8°. St. Petersburg. 1905.**St. Ignatius. Meteorological Observatory.**

11th annual report. 18 pp. 8°. Cleveland. 1905-1906.

**South Australia. Government Astronomer.**

Rainfall in South Australia and the Northern Territory, 1902 and 1903. 65 pp. 8°. Adelaide. 1905.

**Upsala. Université. Observatoire Météorologique.**

Bulletin mensuel. 1905. 74 pp. 8°. Upsal. 1905-6.

**Wallén, Axel.**

Régime hydrologique du Dalelf. (Extr. Bull. Geol. Inst., Upsala. No. 1, v. 8.) 72 pp. 4°. Upsal. 1906.

**RECENT PAPERS BEARING ON METEOROLOGY.**

C. FITZHUGH TALMAN, Acting Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a —

*Bulletin of the American Geographical Society. New York. Vol. 38. July, 1906.*

**Ward, Robert DeCourcey.** The classification of climates. Pp. 401-412.

**Gannett, Henry.** Certain relations of rainfall and temperature to tree growth. Pp. 424-434.

*Engineering News. New York. Vol. 56. Aug. 2, 1906.*

— Examples of the protection of chimneys against lightning. P. 120.

*Nature. London. Vol. 74. Aug. 9, 1906.*

**Lockyer, William J. S.** Atmospheric pressure changes of long duration. Pp. 352-354.

*Proceedings of the Royal Society. London. Series A. Vol. 78.*

**Lockyer, William J. S.** Barometric variations of long duration over large areas. Pp. 43-60.

**Shaw, W[illiam] N[apier].** An apparent periodicity in the yield of wheat for eastern England, 1885-1905. Pp. 69-76.

*Quarterly Journal of the Royal Meteorological Society. London. Vol. 32. July, 1906.*

**Mill, H[ugh] R[obert].** South Africa as seen by a meteorologist during the visit of the British Association in 1905. Pp. 177-188.

**Hands, Alfred.** Some so-called vagaries of lightning reproduced experimentally. Pp. 189-196.

**Stevens, Catharine O.** Note on the value of a projected image of the sun for meteorological study. Pp. 199-201.

*Symons's Meteorological Magazine. London. Vol. 41. July, 1906.*

**Dines, W. H.** Two new light meteorographs for use with unmanned balloons. Pp. 101-102.

**Boys, H. A.** Color of lightning. P. 108.

*Archives des Sciences Physiques et Naturelles. Genève. 4 période. Tome 22. 15 juillet 1906.*

**Brunhes, Bernard.** Sur la théorie des règles de Guibert pour la prévision du temps. Pp. 40-62.

*Bulletin de la Société Belge d'Astronomie. Bruxelles. 11 année. Juin 1906.*  
**Durand-Gréville.** Rubans et couloirs de grain. Pp. 269-292.  
*Comptes Rendus de l'Académie des Sciences. Paris. Tome 143. 9 juillet 1906.*  
**Mercanton, Paul L.** Sur l'inclinaison magnétique terrestre aux époques préhistoriques. Pp. 139-140.  
**Störmer, Carl.** Sur les trajectoires des corpuscules électriques dans l'espace sous l'influence du magnétisme terrestre, avec application aux aurores boréales et aux perturbations magnétiques. Pp. 140-142.  
**Villard, P.** Sur l'aurore boréale. Pp. 143-145.  
*La Nature. Paris. 34 année. 11 août 1906.*  
**Rudaux, Lucien.** Photographies d'aurores boréales. Pp. 175-176.  
*Revue Néphologique. Mons. Juillet 1906.*  
**Nell, Ch. A. C.** L'orientation des bandes polaires. Pp. 52-54.  
**Bracke, A.** La nomenclature des cirrus. Pp. 54-56.  
*Annalen der Physik. Leipzig. 4 Folge. Band 20. No. 9, 1906.*  
**Warburg, E., and Leithäuser, G.** Ueber die Darstellung des Ozons aus Sauerstoff und atmosphärischer Luft durch stille Gleichstromentladung aus metallischen Elektroden. Pp. 734-742.  
**Warburg, E., and Leithäuser, G.** Ueber den Einfluss der Feuchtigkeit und der Temperatur auf die Ozonisierung des Sauerstoffs und der atmosphärischen Luft. Pp. 751-758.  
*Beiträge zur Physik der freien Atmosphäre. Strassburg. 1 Band, 1906.*  
**Bjerknes, V., and Sandström, J. W.** Hilfsgrößen zur Berechnung der Druckverteilung in der Atmosphäre an den internationalen Tagen 1900-1903. Pp. 1-17.  
**Schmidt, A.** Die Atmosphäre des Weltraums. Pp. 18-29.  
*Geographische Abhandlungen. Leipzig. Band 7, Heft 4. 1906.*  
**Vujevic, Paul.** Die Theiss; eine potamologische Studie. Pp. 1-76.  
*Meteorologische Zeitschrift. Braunschweig. Band 23. Juli 1906.*  
**Steiner, L.** Graphische Methode zur Bestimmung der Insolationsmenge. Pp. 294-300.  
**Kassner, C[arl].** Normale Monatsmittel der Temperatur und des Niederschlages für den Brocken. Pp. 300-306.  
**Nordmann, Charles, and Le Cadet, G.** Messungen des Potentialgefälles und der Ionisation der Atmosphäre während der totalen Sonnenfinsternis am 30 August 1905. Pp. 306-310.  
 — Der Frühlingseinzug in Mitteleuropa nach Prof. E. Ihne. Pp. 313-315.  
**Sapper, K.** Antipassat in Westindien und Mittelamerika. Pp. 315-316.  
**H[ann], J[ulius].** Luft- und Wassertemperaturen im Mittelemeere. Pp. 316-317.  
**Conrad, V.** Bemerkungen zum Zusammenhang des "Knisterns im Telephon" auf dem Sonnbllick mit Potential und Zerstreuung. Pp. 318-319.  
**Greim, G.** Zur Entstehung des Graupels. P. 320.  
**Siegel, Franz.** Resultate der meteorologischen Beobachtungen im Jahre 1905 am Observatorium erster Ordnung zu Curityba (Staat Parana). Pp. 321-322.  
**Nordmann, Charles.** Ueber einige Experimente zur Bestimmung der Ionisation der Atmosphäre, die in Algerien anlässlich der totalen Sonnenfinsternis vom 30 August 1905 angestellt wurden. Pp. 322-323.  
**C., V.** Luftelektrische und photometrische Beobachtungen während der totalen Sonnenfinsternis vom 30 August 1905 im Palma (Mallorca) vom J. Elster, H. Geitel, und F. Harms. Pp. 323-325.  
**H[ann], J[ulius].** Meteorologische Beobachtungen zu Good Hope im arktischen Nordamerika 1900-1903. Pp. 329-330.  
*Petermanns Mitteilungen. Gotha. Band 52. 1906.*  
**Neumann, L.** Deutschlands mittlere Jahres-, Januar-, April-, Juli-, und Oktober-Temperaturen. Pp. 140-142.  
*Das Weltall. Berlin. 6 Jahrgang. Juli 1, 1906.*  
**Krebs, Wilhelm.** Wogenbewegungen der Atmosphäre, erkennbar auf Luftdruckkarte und Barogramm. Pp. 307-312.  
*Das Wetter. Berlin. 23 Jahrgang.*  
**Klengel, Friedrich.** Die Niederschlagsverhältnisse von Deutsch-Südwestafrika. (Mai 1906.) Pp. 103-107.  
**Stiepani, Martin.** Luzon in seinen klimatischen Beziehungen. (Mai 1906.) Pp. 107-111.  
**Mylius, G.** Wetterinstinkt. (Juni 1906.) Pp. 121-125.  
**Klengel, Friedrich.** Die Niederschlagsverhältnisse von Deutsch-Südwestafrika. (Juni 1906.) Pp. 125-130.  
**Stiepani, Martin.** Luzon in seinen klimatischen Beziehungen. (Juni 1906.) Pp. 130-134.  
**Schips, K.** Vom "Wettermachen" im grossen. (Juni 1906.) Pp. 137-140.  
**Diesner, P.** Witterung auf der Zugspitze in Winterhalbjahr 1905-6. (Juni 1906.) Pp. 140-142.  
**Mylius, W.** Wetterinstinkt. (Juli 1906.) Pp. 145-153.  
**Klengel, Friedrich.** Die Niederschlagsverhältnisse von Deutsch-Südwestafrika. (Juli 1906.) Pp. 153-156.  
**Hecker, Alfred.** Die Wettervorhersage. (Juli 1906.) Pp. 161-166.

*Wiener Luftschiffer Zeitung. Wien. 5 Jahrgang. Juli, 1906.*  
 Kress, Wilhelm. Der Einfluss des Windes auf drei in der Luft  
 fliegende Körper. Pp. 141-143.

*Hemel en Dampkring. Amsterdam. 4 Jaargang. Juli, 1906.*  
 Smits, P. J. Is de intensiteit van den regenval periodiek? Pp.  
 37-42.

*Memorie della Società degli Spektroscopisti Italiani. Catania. Vol. 35. Dis-  
 pensa 6a, 1906.*  
 Bemporad, A. Sul modo di variare della radiazione solare du-  
 rante le fasi di un'eclisse. Pp. 89-102.

*Rivista Marittima. Roma. Vol. 59. Giugno, 1905.*  
 Eredia, Filippo. I venti forti nelle coste italiane dell'Adriatico e  
 dell'Jonio. Pp. 533-540.

#### WEATHER BUREAU MEN AS EDUCATORS.

The following lectures and addresses by Weather Bureau men are reported:

Mr. G. Hass-Hagen, June 8, 1906, before the teachers of the Anderson County Normal Institute, Palestine, Tex., on

"Weather Bureau instruments, forecasting, and the utility of the Bureau's work".

Mr. N. R. Taylor, July 26, 1906, before the Southwest Missouri Summer Normal School, in the auditorium of the Springfield, Mo., High School Building, on "Storms".

Classes from colleges, schools, and academies have visited Weather Bureau offices, to study the instruments and equipment and receive informal instruction, as reported from the following offices:

Huron, S. Dak., July 18, 1906, students of the summer school of the Huron College.

Springfield, Mo., July 23, 24, and 25, 1906, the teachers attending the summer normal school at that place.

Vicksburg, Miss., July 13, 1906, a party of teachers spending the summer at the St. Francis Xavier Academy, in that city.

#### FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

were issued in advance of these readings—A. J. Henry, Professor and District Forecaster.

##### DENVER FORECAST DISTRICT.

Thunderstorms were numerous and occurred with heavy precipitation almost daily in a narrow belt extending along the Continental Divide from southwestern Wyoming to central New Mexico; elsewhere in the Rocky Mountain districts rainfall was generally below the normal and temperature was unusually low. At several stations on the eastern slope the month was the coolest July on record.—F. H. Brandenburg, District Forecaster.

##### SAN FRANCISCO FORECAST DISTRICT.

The month as a whole was one of quite pleasant weather. Afternoon thunderstorms were frequent in the Sierra Madre and in the southern portion of the Sierra Nevada mountains. Along the coast the month was marked by considerable cloudiness with morning and afternoon fogs.—A. G. McAdie, Professor and District Forecaster.

##### PORTLAND, OREG., FORECAST DISTRICT.

The month was the warmest July on record since the early seventies, and then it was equaled and not exceeded. Rainfall was light and no heavy rains were reported in any part of the North Pacific States. Warnings were not issued or required.—E. A. Beals, District Forecaster.

#### RIVERS AND FLOODS.

There was no high water of consequence during the month in any of the rivers on which river and flood service is maintained.

The Mississippi and Missouri rivers were highest at the beginning of the month, and fell slowly throughout the month.

The Ohio River and the rivers of the Southeastern States were highest from the 15th to the 25th owing to the heavy rains during that period; several of the smaller streams showed marked rises, especially in the headwaters, due to heavy local rains.

Flood stages were reached at but two stations; warnings were issued for high water in the Trinity River on July 27 and were fully justified.

On July 1, 1906, Columbia, S. C., was made a district center, with territory comprising the watersheds of the Edisto and Santee rivers; and the district center for the rivers of California was transferred from San Francisco to Sacramento, Cal.; provision is being made for additional stations and improved river service in both these districts.

The highest and lowest water, mean stage, and monthly range at 280 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on

##### NEW ORLEANS FORECAST DISTRICT.

Rainfall was excessive in nearly all parts of the west Gulf districts, and temperature was generally below the normal. Special warnings were neither issued nor required.—I. M. Cline, District Forecaster.

##### LOUISVILLE FORECAST DISTRICT.

Moderate temperature and showery weather prevailed throughout the month. The principal cool spell extended from the 3d to 9th, and there were no protracted periods of unusually high temperature. Heavy thunderstorms occurred at frequent intervals and some damage was caused by heavy local rains. No special warnings were issued.—F. J. Walz, District Forecaster.

##### CHICAGO FORECAST DISTRICT.

No severe storms occurred and no storm warnings were issued. A marked area of high pressure during the first week of the month caused low temperatures in the cranberry marshes of Wisconsin, minimum readings of 33° being recorded at two places on the morning of the 6th. Warnings of light frost

Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

## CLIMATOLOGICAL SUMMARY.

By Mr. JAMES BERRY, Chief of the Climatological Division.

## TEMPERATURE AND PRECIPITATION BY SECTIONS, JULY, 1906.

In the following table are given, for the various sections of the Climatological Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and

lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.							
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.			
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.		
Alabama	78.8	-1.2	6 stations	100	1	Riverton	55	4	8.50	+3.50	Maple Grove	14.11	Thomasville	3.35		
Arizona	81.9	-0.3	Fort Mohave	122	24	Quakingasp.	30	3	1.94	+0.28	Pinal Ranch	5.33	Mohawk Summit	0.00		
Arkansas	76.7	-3.4	6 stations	99	5 dates	Ozark	48	3	5.96	+2.17	Arkansas City	12.95	La Crosse	0.97		
California	76.8	+2.7	Indio	120	24	Tamarack	28	15	0.04	-0.01	Montague	1.27	Many stations	0.00		
Colorado	63.4	-3.2	Lamar	101	23	Breckenridge	27	57	2.50	+0.28	Stonewall	7.44	Manassa	0.00		
Florida	81.0	-0.5	Las Animas	101	3 dts.	Longs Peak	27	30			Brooksville	20.54	Key West	1.92		
Georgia	77.9	-2.0	Fort Meade	99	22	DeFuniak Springs	60	1,2	9.50	+2.40	St. Marys	20.03	Macon	3.88		
Hawaii	74.7		Marianna	99	9	Diamond	56	10	8.41	+3.21	Honolulu Val, Maui	20.22	4 stations	0.00		
Idaho	70.6	+3.4	Elberton	101	1	Volcano House, Ha.	50	5	15.36		Salem	1.32	9 stations	0.00		
Illinois	73.9	-1.8	Marshallville	101	15	Forney, Lake	34	1	0.19	-0.36	Carlinville	7.73	2 stations	0.47		
Indiana	73.7	-1.9	Pahala, Hawaii	95	18	Streator	43	5	2.41	-1.08	Vevay	7.95	Salem	0.57		
Iowa	70.9	-3.5	Atlantic	102	21	Plymouth	45	23	3.15	-0.03	Independence	7.05	Tipton	0.26		
Kansas	73.8	-4.0	Garnet	108	21	Washta	42	7,8	3.04	-1.31	Yates Center	9.46	Oberlin	1.71		
Kentucky	75.2	-2.1	Bloomington	100	22	Wallace	42	4	4.65	+0.82	Williamsburg	11.52	Franklin	2.03		
Louisiana	81.3	-0.3	Palestine	100	15	Farmers	51	25	6.02	+1.92	Franklin	13.84	Crowley	2.55		
Maryland and Delaware	74.0	-1.3	Mount Vernon	97	11	Greensburg	51	25,27			Seaford, Del.	11.56	Cumberland, Md	1.64		
Michigan	67.7	-1.0	Porto Bello, Md.	96	1,2	Plain Dealing	60	41	7.97	+2.45	Grafton, N. H.	5.93	Sault Sainte Marie	0.22		
Minnesota	68.3	-1.3	Highbridge	100	2	Ruston	60	5			Patten, Me.	7.42	Two Harbors	0.43		
Mississippi	79.3	-1.7	Alexandria	102	1	Greensburg	60	41			Charlottesville	15.88	Hazlehurst	2.82		
Missouri	74.7	-2.5	Reserve	102	1,6,9	Plain Dealing	51	25	5.99	+1.06	Corinth	8.18	Bolivar	0.40		
Montana	67.6	+2.0	Cambridge, Md.	96	1,2	Ruston	60	5			Deer Park, Md.	2.64	Darksville	2 stations		
Nebraska	70.2	-3.6	Plentywood	109	29	Grayling	28	15,28	0.59	-0.91	Nye	7.88	Springview	0.37		
Nevada	74.7	+4.2	Fairbury	102	20	Agate	38	4	2.70	-0.76	Medina	4.58	Palmetto	0.00		
New England*	69.1	-0.3	Logan	114	21,22	Potts	32	25	0.68	+0.31	Kenton, Okla.	8.17	Voluntown, Conn.	1.89		
New Jersey	72.8	-1.0	Van Buren, Me.	97	14	Grafton, N. H.	35	6	4.64	+0.77	Charlottesville	8.28	Englewood	3.44		
New Mexico	70.2	-2.6	3 stations	94	3 dates	3 stations	33	3 dates	2.57	-0.37	Patten, Me.	7.42	Two Harbors	0.43		
New York	69.4	-0.2	San Marcial	110	22,23	Charlottesville	46	8	5.58	+0.32	Dayton	15.88	Corinth	2.82		
North Carolina	75.6	-1.6	Elmira	94	20	Dayton	46	7			Indian Lake	8.62	Selma	1.85		
North Dakota	66.9	-0.6	3 stations	100	1	Pink Beds	46	10,28	9.23	+3.38	Garrettsville	17.15	Asheville	4.60		
Ohio	72.1	-1.8	Melville	102	20	McKinney	34	17	1.97	-0.53	Medina	5.92	Sentinel Butte	0.13		
Oklahoma and Indian Territories	76.5	-4.2	Norwalk	98	19	Garrettsville	43	25	5.14	+1.17	Kenton, Okla.	10.25	Willoughby	1.56		
Oregon	71.3	+6.5	Mangum, Okla.	103	27	Medina	43	25	5.26	+1.64	Harrington, Okla.	8.74	Cache, Okla.	0.92		
Pennsylvania	71.3	-0.7	Umatilla	115	4	Rosebud	56	13	8.40	+2.71	Centralia	2.07	23 stations	0.00		
Porto Rico	78.3		Bellefonte	95	2	Rosebud	38	9	1.45	-1.32	Colville	8.98	Hyndman	1.41		
South Carolina	78.4	-1.3	Adjuntas	95	21,22	Ashercroft	38	15			Bayard	12.50	Corpus Christi	0.41		
South Dakota	69.6	-2.3	Guanica	95	25	Ashercroft	38	15	6.90	+2.82	Claytonville	18.42	Tropic	2.99		
Tennessee	75.2	-2.1	Yorkville	100	1	Claytonville	40	4,9	4.71	+1.51	Alvin	16.82	3 stations	T.		
Texas	80.3	-2.0	Cherry Creek	107	21	Coyote	26	1	0.85	+0.08	Blacksburg	12.50	Callaville	2.66		
Utah	71.6	-0.1	Big Springs	108	23	Burkes Garden	43	19	6.05	+1.33	Centralia	10.69	Lincoln	1.66		
Virginia	74.0	-1.7	St. George	110	6	Burkes Garden	43	10			Goldendale	0.74	8 stations	0.00		
Washington	72.4	+5.6	Rocky Mount	101	1	Burkes Garden	39	8	0.17	-0.44	Colville	7.44	Moorfield	1.50		
West Virginia	72.4	-1.3	Mottingers Ranch	112	4,21	Burkes Garden	39	26			Princeton	6.10	Florence	0.79		
Wisconsin	68.7	-1.5	Berkeley Springs	98	11	Burkes Garden	45	25	4.54	-0.33	Alcovia	2.43	Green River	0.62		
Wyoming	62.3	-2.1	Sutton	98	13	Burkes Garden	36	5	2.55	-1.36						

\* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

† 49 stations, with an average elevation of 645 feet.

‡ 142 stations.

## THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

## PRESSURE.

The distribution of atmospheric pressure for July over the United States and Canada is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

The isobaric chart shows well-marked variations from normal conditions and is probably without parallel during any July in the history of the Weather Bureau.

The persistence of areas of high pressure over the northern Rocky Mountain slope and upper Missouri Valley was very

unusual and instead of the normal summer extension of the southwestern low over that region there appears a well-defined area of high pressure. The high pressure area that normally extends well into the South Atlantic and East Gulf States receded eastward during July and its influence on the prevailing weather over that section was correspondingly lessened.

Pressure on the Pacific coast was somewhat lower than the average, especially over the region between the Coast and Cascade ranges of mountains, while over the New England States and the Canadian Maritime Provinces the pressure was above the average.

The pressure usually increases from June to July over all portions of the United States and Canada, except over a limited area on the coast of California and over parts of New England and in the St. Lawrence Valley. During the present season the increase from June to July was especially marked over the entire Rocky Mountain and eastern Plains region from the Mexican boundary as far north as the field of observation extends. As a result of this unusual distribution of pressure the surface winds of the Mississippi Valley and southern slope regions were materially deflected from their normal southerly and easterly course during July, and blew largely from northerly or westerly points.

#### TEMPERATURE.

The continued high pressure over the northern Rocky Mountain and slope regions brought to that section the usual cool weather accompanying high pressure areas and in conjunction with the decreased pressure over the South Atlantic and Gulf States affected correspondingly the weather over nearly the entire area of the United States east of the Rocky Mountains.

Over the southern slope and Mississippi Valley cool northerly winds predominated with temperatures much below the normal.

Over the territory from central Texas to South Dakota, and from Colorado and Wyoming east to the Mississippi Valley, the daily temperatures averaged from 2° to more than 4° below the normal. In portions of the above region the average for the month was the lowest recorded in any July in a period of over thirty years.

West of the Rocky Mountains and north of the Canadian boundary the temperature was above the average. Over the eastern parts of Washington and Oregon the daily temperatures were exceptionally high throughout practically the whole month. At Spokane and Walla Walla, Wash., and Baker City, Oreg., the monthly means were the highest on record for July.

Maximum temperatures east of the Rocky Mountains were, as a rule, moderate; over large sections of New England, the Middle Atlantic States, and the Lake region the maximum temperatures did not reach 90°. Over small areas in Alabama, southern and western Texas, Oklahoma, South Dakota, and Montana maximum temperatures of 100°, or more, were recorded. West of the Rocky Mountains maximum temperatures were unusually high. Over the greater portion of southwestern Arizona and southeastern California maximum temperatures of 110° to 120° were recorded, and over the whole of northern California, except the coast and mountain districts, and the greater parts of Oregon and Washington readings from 100° to 110° were recorded. In western Washington the maximum temperatures on the 3d were the highest ever recorded in that section.

Temperatures below freezing were recorded at a few mountain stations in Colorado and Wyoming.

*In Canada.*—Prof. R. F. Stupart says:

The mean temperature of the month was above the average in nearly all parts of the Dominion, districts near Lake Superior and southwestern

Ontario alone showing a very slight negative departure. A positive departure of 2° in eastern Manitoba increased westward to 6° in parts of Alberta and in British Columbia, while over the larger portions of Ontario, Quebec, and the Maritime Provinces the positive departure ranged between 1° and 3°.

#### PRECIPITATION.

The usual heavy rains over the lower Mississippi Valley and Gulf States prevailed during the month, and amounts in excess of 10 inches were recorded in scattered localities in that section. Heavy rains for the season occurred generally over Texas and in a narrow belt along the eastern slope of the Continental Divide from central New Mexico to southern Wyoming. In the latter section the fall was unusually heavy, especially at the higher elevations where rains were of almost daily occurrence, and the totals for the month were the largest on record.

Over nearly all sections east of the one hundredth meridian, except the Dakotas and the upper Mississippi Valley, the month was one of abundant rainfall. The usual summer rains prevailed over Arizona and New Mexico, and amounts from 4.00 to over 8.00 inches were recorded at numerous points in those Territories.

On the Pacific coast and generally over the Plateau region the precipitation was deficient. It was also less than average over the northern tier of States as far east as the upper Lake region.

*In Canada.*—Prof. Stupart says:

The rainfall was deficient over the greater part of the Dominion, but over the more central counties of Ontario and the southern portion of Nova Scotia it was excessive, the largest departures recorded being in the districts between Halifax and Yarmouth, Nova Scotia. In the western provinces the most pronounced deficiency occurred in southeastern Alberta, where the fall was very scant, while in northern parts and in Manitoba it was more nearly average. In Ontario just west of the Ottawa Valley the fall was decidedly deficient, and this was also the case in northern New Brunswick and eastern Quebec.

#### HUMIDITY AND CLOUDINESS.

The humidity was equal to or in excess of the average over all sections of the United States, none of the geographical divisions showing values below normal. The month was also one of general excess of cloudiness, except in the Lake region, the upper Mississippi and Missouri valleys, and generally over the Pacific coast.

The average and extreme values of the principal climatological data are given for each station in Tables I-VI, but the averages by districts are summarized in the following tables:

#### Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England	9	68.0	— 1.0	+ 3.2	+ 0.5
Middle Atlantic	13	74.1	— 0.7	+ 5.3	+ 0.8
South Atlantic	10	77.6	— 1.5	— 1.1	— 0.2
Florida Peninsula*	8	81.1	— 0.4	— 1.0	— 0.1
East Gulf	8	79.4	— 1.2	— 8.0	— 1.1
West Gulf	7	80.5	— 1.5	— 4.0	— 0.6
Ohio Valley and Tennessee	12	74.6	— 1.8	— 2.7	— 0.4
Lower Lake	8	70.9	— 0.3	+ 5.7	+ 0.8
Upper Lake	10	67.6	— 0.2	+ 10.0	+ 1.4
North Dakota*	8	67.5	— 0.5	+ 14.1	+ 2.0
Upper Mississippi Valley	13	72.7	— 2.1	+ 0.8	+ 0.1
Missouri Valley	11	72.4	— 2.8	+ 6.6	+ 0.9
Northern Slope	7	68.7	— 0.7	+ 7.2	+ 1.0
Middle Slope	6	72.6	— 3.6	+ 0.8	+ 0.1
Southern Slope*	6	76.4	— 2.9	— 7.1	— 1.0
Southern Plateau*	13	77.9	— 0.8	+ 2.6	+ 3.4
Middle Plateau*	8	71.6	+ 0.8	+ 0.8	+ 0.1
Northern Plateau*	12	74.5	+ 6.4	+ 12.3	+ 1.8
North Pacific	7	64.6	+ 3.3	+ 10.6	+ 1.5
Middle Pacific	5	65.8	+ 1.4	+ 9.8	+ 1.4
South Pacific	4	72.9	+ 2.2	+ 6.0	+ 0.9

\* Regular Weather Bureau and selected cooperative stations.

## Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percent- age of normal.	Current month.	Accumu- lated since Jan. 1.
<i>Inches.</i>					
New England	9	3.99	111	+0.4	+1.0
Middle Atlantic	13	5.65	133	+1.4	-0.5
South Atlantic	10	7.51	127	+1.6	+0.2
Florida Peninsula*	8	9.65	147	+3.1	+7.9
East Gulf	8	7.11	129	+1.6	-3.6
West Gulf	7	4.04	129	+0.9	-6.3
Ohio Valley and Tennessee	12	5.03	123	+0.9	-5.5
Lower Lake	8	4.02	129	+0.9	-4.1
Upper Lake	10	2.31	77	-0.7	-2.2
North Dakota*	8	1.58	61	-1.0	+1.8
Upper Mississippi Valley	13	2.33	61	-1.5	-2.6
Missouri Valley	11	2.95	69	-1.3	-2.7
Northern Slope	7	1.12	65	-0.6	+0.2
Middle Slope	6	3.92	134	+1.0	-1.4
Southern Slope*	6	3.90	122	+0.7	+0.5
Southern Plateau*	13	1.81	138	+0.5	+2.2
Middle Plateau*	8	0.88	129	+0.2	+3.6
Northern Plateau*	12	0.19	28	-0.5	-0.3
North Pacific	7	0.14	15	-0.8	-7.6
Middle Pacific	5	0.02	17	-0.1	+4.6
South Pacific	4	T.	100	0.0	+6.4

\* Regular Weather Bureau and selected cooperative stations.

## Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.		Date.	Velocity.	Direction.
				Date.	Velocity.			
Columbus, Ohio	3	52	nw.	Point Reyes Light, Cal.	30	50	nw.	
Denver, Colo.	14	52	n.	Do	31	56	nw.	
Lincoln, Nebr.	1	60	nw.	Peoria, Ill.	28	50	w.	
Do	25	51	n.	Port Huron, Mich.	22	52	nw.	
New York, N. Y.	17	55	w.	Topeka, Kans.	1	56	w.	

## Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.		Average.	Departure from the normal.
			Districts.	Average.	Districts.	Average.
New England	5.6	+ 0.7	Missouri Valley	4.1	— 0.3	
Middle Atlantic	5.9	+ 1.1	Northern Slope	2.9	+ 0.9	
South Atlantic	6.4	+ 1.4	Middle Slope	4.7	+ 0.7	
Florida Peninsula	4.9	- 0.1	Southern Slope	5.4	+ 1.2	
East Gulf	6.1	+ 1.1	Southern Plateau	3.9	+ 0.4	
West Gulf	5.1	+ 0.9	Middle Plateau	3.8	+ 0.6	
Ohio Valley and Tennessee	5.7	+ 1.1	Northern Plateau	2.1	- 0.6	
Lower Lake	4.6	- 0.1	North Pacific	4.0	- 0.1	
Upper Lake	4.2	- 0.5	Middle Pacific	4.2	+ 0.2	
North Dakota	3.9	- 0.4	South Pacific	2.4	- 0.4	
Upper Mississippi Valley	4.1	- 0.2				

## Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.		Average.	Departure from the normal.
			Districts.	Average.	Districts.	Average.
New England	85	+ 5	Missouri Valley	67	+ 1	
Middle Atlantic	78	+ 4	Northern Slope	57	+ 5	
South Atlantic	84	+ 4	Middle Slope	67	+ 7	
Florida Peninsula	80	0	Southern Slope	68	+ 9	
East Gulf	81	+ 3	Southern Plateau	49	+ 9	
West Gulf	77	+ 3	Middle Plateau	46	+ 9	
Ohio Valley and Tennessee	76	+ 7	Northern Plateau	40	0	
Lower Lake	73	+ 4	North Pacific	75	0	
Upper Lake	73	+ 1	Middle Pacific	68	+ 3	
North Dakota	74	+ 5	South Pacific	66	+ 2	
Upper Mississippi Valley	68	0				

## DESCRIPTION OF TABLES AND CHARTS.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

For description of tables and charts see page 38 of REVIEW for January, 1906.

TABLE I.—Climatological data for U. S. Weather Bureau stations, July, 1906.

Stations.	Elevation of instruments.		Pressure, in inches.				Temperature of the air, in degrees Fahrenheit.						Precipitation, in inches.				Wind.								
	Barometer above sea level, feet.	Thermometers above ground.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Date.	Mean minimum.	Date.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity.			
	Barometer above sea level, feet.	Anemometer above ground.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Date.	Mean minimum.	Date.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Miles per hour.	Direction.	Date.			
<i>New England.</i>																									
Eastport.	76	69	85	29.88	29.97	+.04	59.7	—1.0	84	18	68	47	1	52	31	56	25	3.99	+.0.4	11	5,308	s.	25		
Portland, Me.	103	81	117	29.86	29.98	+.03	67.6	—0.9	85	18	75	52	6	60	24	62	60	2.91	—1.9	9	5,463	s.	34		
Concord.	288	70	79	29.66	29.96	+.00	69.6	—0.3	88	17	80	46	7	59	32	50	3.14	—0.8	11	2,881	n.	19			
Burlington.	404	12	47	29.54	29.96	+.02	67.9	—2.8	86	14	77	45	6	58	29	52	2.33	—1.8	5,474	s.	29				
Northfield.	876	16	70	29.06	29.99	+.05	64.8	—0.3	86	15	77	38	6	52	37	61	59	82	4.30	+.0.6	14	3,912	s.	34	
Boston.	125	115	185	29.85	29.98	+.02	70.1	—1.2	89	22	77	55	1	64	62	66	63	81	5.38	+.1.9	5,967	s.w.	26		
Nantucket.	12	14	90	29.98	29.99	+.01	66.6	—0.6	80	3	72	53	6	61	16	64	63	96	4.50	+.2.1	17	10,946	s.w.	42	
Block Island.	26	11	46	29.97	30.00	+.03	67.7	—0.7	81	22	72	52	1	63	17	65	64	98	3.88	+.0.7	9,367	s.w.	40		
Narragansett.	9																								
Providence.	160	57	67	29.82	29.99	+.02	70.6	—2.4	89	22	79	52	7	62	24	65	63	84	5.29	—1.8	18	3,980	s.w.	18	
Hartford.	159	122	132	29.81	29.98	+.01	72.8	—0.3	88	22	82	51	7	63	27	67	65	84	5.09	—1.4	4,754	s.	28		
New Haven.	106	116	155	29.87	29.98	+.01	71.8	—0.0	88	22	79	52	7	64	26	67	65	82	5.62	+.0.7	16	5,688	s.	38	
<i>Mid. Atlantic States.</i>																									
Albany.	97	102	115	29.87	29.97	+.01	72.8	—0.4	89	14	82	52	6	63	30	66	63	74	3.91	—0.0	12	4,282	s.	29	
Binghamton.	875	79	90	29.06	29.97	—0.0	70.0	—0.3	89	20	80	50	5	25	60	31	3.44	—0.1	11	2,863	e.	31			
New York.	314	108	350	29.65	29.98	—0.0	74.8	—1.3	89	10	82	61	7	68	25	67	64	77	3.21	—1.0	13	6,506	s.	55	
Harrisburg.	374	94	104	29.58	29.98	—0.0	74.4	—1.5	89	2	83	58	7	66	24	67	63	71	1.74	—2.5	11	4,065	s.	38	
Philadelphia.	117	116	184	29.87	29.99	+.01	75.6	—0.1	89	2	83	60	7	68	23	68	64	73	3.38	—1.2	6,419	s.w.	28		
Seranton.	805	111	119	29.13	29.98	—0.0	72.0	—0.8	88	19	81	55	25	63	29	65	62	73	1.93	—1.2	3,963	s.w.	36		
Atlantic City.	52	37	48	29.94	29.99	+.01	71.4	—0.5	82	21	76	61	8	67	16	68	66	85	4.97	—1.5	11	5,999	s.w.	26	
Cape May.	17	48	52	29.99	30.01	+.03	72.0	—1.6	85	21	76	59	7	68	15	68	65	77	1.78	—1.3	5,536	s.	24		
Baltimore.	123	69	117	29.85	29.97	—0.1	75.9	—1.3	91	2	84	58	7	68	23	68	65	73	7.96	—3.3	14	4,794	s.w.	27	
Washington.	112	59	76	29.86	29.98	—0.2	75.2	—1.6	91	2	84	56	7	67	24	69	67	79	6.80	—2.2	15	3,895	s.	24	
Cape Henry.	18	11	58	29.8	30.00	+.01	76.4	—0.6	94	2	82	64	7	70	22	68	65	9.19	—3.6	16	9,182	s.	39		
Lynchburg.	681	88	88	29.26	29.99	—0.2	75.6	—1.9	92	1	85	55	8	66	28	69	67	80	4.10	—0.2	17	2,479	s.w.	25	
Mount Weather.	1,725	10	57	28.22	29.99	—0.6	69.8	—0.3	84	10	77	54	7	63	19	64	61	79	2.21	—11	7,953	s.e.	27		
Norfolk.	91	102	111	29.90	29.99	—0.1	76.6	—1.9	92	1	83	65	7	70	22	72	70	85	8.90	—3.0	18	6,523	s.	32	
Richmond.	144	145	153	29.84	29.99	—0.2	76.6	—1.6	94	1	85	57	7	68	25	69	65	75	1.97	—1.9	5,865	s.	45		
Wytheville.	2,298	40	47	27.68	29.98	—0.3	70.6	—1.7	88	2	80	54	10	62	28	65	64	87	7.60	—3.9	21	2,542	w.	20	
<i>&amp; Atlantic States.</i>																									
Asheville.	2,255	58	75	27.70	29.98	—0.4	71.2	—0.3	88	2	80	55	10	62	28	66	65	88	4.57	—1.5	2,51	—1.6	2,516	s.	25
Charlotte.	778	68	76	28.18	30.00	—0.2	76.5	—1.7	94	1	84	64	9	69	22	70	68	82	5.57	—0.0	17	3,893	s.e.	20	
Hatteras.	11	12	47	30.00	30.61	—0.0	77.2	—0.7	86	1	82	67	10	72	17	74	73	88	3.33	—0.1	16,006	s.w.	26		
Raleigh.	376	71	79	29.60	29.99	—0.3	77.0	—0.1	97	1	85	64	24	28	69	70	69	82	5.35	—0.4	16	4,392	s.w.	24	
Wilmington.	78	81	91	29.90	29.98	—0.3	78.1	—1.6	91	1	84	67	8	72	17	73	72	85	7.64	—0.4	16	5,649	s.w.	3	
Charleston.	45	48	92	29.95	30.00	—0.3	79.8	—2.0	90	1	86	67	25	74	16	75	73	82	8.68	—1.1	18	7,345	s.	32	
Columbia, S. C.	351	41	57	29.61	29.98	—0.4	78.1	—2.5	94	1	86	66	26	70	24	72	70	84	8.51	—2.9	20	4,261	s.w.	26	
Augusta.	180	89	97	29.79	29.98	—0.4	78.6	—2.5	92	1	87	64	26	70	22	73	71	82	14.00	—8.7	17	4,085	s.	38	
Savannah.	65	81	89	29.63	30.00	—0.3	79.6	—2.3	91	1	87	67	26	72	18	74	72	85	5.42	—0.4	20	5,024	s.w.	27	
Jacksonville.	43	101	129	29.94	29.99	—0.4	80.4	—1.7	91	2	88	68	24	74	21	74	73	85	9.86	—2.5	18	6,728	s.w.	30	
<i>Florida Peninsula.</i>																									
Jupiter.	13	10	48	29.99	30.02	—0.1	80.8	—0.0	91	27	87	71	27	74	20	75	70	80	8.93	—4.0	14	6,512	s.	38	
Key West.	22	10	53	29.98	30.00	—0.3	83.6	—0.3	90	26	89	75	24	78	13	76	73	92	1.9	—1.9	13	5,424	e.	38	
Sand Key.	25	40	71	29.97	30.00	—0.3	83.5	—0.4	94	27	88	70	18	79	14	81	76	93	1.50	—1.3	13	5,622	e.	48	
Tampa.	35	79	96	29.97	30.00	—0.4	80.4	—1.0	95	17	88	68	6	73	22	76	74	83	5.7	—2.3	23	4,656	s.e.	27	
<i>East Gulf States.</i>																									
Atlanta.	1,174	190	216	28.77	29.98	—0.4	76.0	—2.4	93	1	84	64	31	68	23	69	67	80	8.93	—4.0	14	6,512	s.	38	
Macon.	370	55	66	29.60	29.98	—0.4	80.6	—0.5	95	1	89	68	24	72	23	74	73	88	3.38	—0.2	17	3,119	s.w.	30	
Thomasville.	273	8	57	29.70	29.99	—0.4	80.2	—1.3	94	24	90	66	22	71	26	74	73	86	8.69	—2.0	19	3,281	s.	30	
Pensacola.	56	79	96	29.21	29.97	—0.4	80.7	—0.1	90	6	86	70	2	75	18	78	77	84	4.47	—2.3	13	6,733	s.w.	36	
Anniston.	741	9	58	29.21	29.99	—0.4	77.0	—1.0	96	1	87	60	5	67	28	78	77	88	13.78	—8.7	18	2,895	s.e.	36	
Birmingham.	700	136	144	29.24	29.99	—0.2	77.6	—3.1	96	1	86	64	24	70	24	74	72	88	8.18	—2.8	14	4,289	s.w.	37	
Mobile.	57	98	106	29.91	29.97	—0.4	81.1	—0.1	95	7	89	71	22	74	21	74	72	89	6.87	—0.3	20	3,172	s.w.	32	
Montgomery.	223	100	112	29.78	29.97	—0.5	79.7	—1.8	94	1	89	66	24	71	24	72	70	81	7.93	—3.4	16	4,001	s.w.	36	
Meridian.	375	84	98	29.57	29.95	—0.7	78.7	—1.3	94	1	88	64	6	69	28	72	70	89	7.49	—0.4	13	2,972	s.w.	33	
Vicksburg.	247	62	74	29.70	29.97	—0.3	79.5	—1.8	92	1	88	67	5	71	22	73	71	82	3.17	—2.0	11	3,638	s.	28	
New Orleans.	51	88	121	29.92	29.97	—0.3	82.4	—0.2	94	1	90	66	4	72	26	73	71	81	7.82	—0.8	18	5,031	s.w.	27	
<i>West Gulf States.</i>																									
Shreveport.	249	77	84	29.70	29.96	—0.2	80.5	—2.0	96	15	90	65	4	72	30	72	70	77	7.77	—4.0</td					

TABLE I.—Climatological data for U. S. Weather Bureau stations, July, 1906—Continued.

Stations.	Elevation of instruments.		Pressure, in inches.		Temperature of the air, in degrees Fahrenheit.								Precipitation, in inches.		Wind.			Total snowfall.				
	Barometer above sea level, feet.	Thermometers above ground.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with 01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity.		
	Barometer above sea level, feet.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Date.	Minimum.	Date.	Mean minimum.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with 01, or more.	Miles per hour.	Direction.	Date.		
<i>Up. Lake Reg.—Con't.</i>																						
Grand Rapids	707	121	162	29.21	29.97	-.01	70.6	-2.7	91	22	81	49	6	60	28	58	68	2.52	+.0.2	9	5,851	
Houghton	668	66	74	29.23	29.98	-.01	66.0	.....	90	12	76	46	5	56	30	.....	1.27	.....	9	3,948		
Marquette	734	77	116	29.18	29.97	+.01	64.5	-0.4	92	21	73	45	6	56	31	58	54	70	1.78	-1.2	10	5,698
Port Huron	638	70	120	29.28	29.97	-.01	68.8	+.0.3	91	22	77	52	24	61	28	63	60	75	2.72	+.0.3	11	5,985
Sault Ste. Marie	614	40	61	29.29	29.98	+.01	64.8	+.0.3	88	21	75	45	24	54	32	59	55	74	0.22	2.8	6	4,533
Chicago	823	140	310	29.10	29.97	-.01	71.6	-0.4	92	22	77	59	3	66	64	61	72	4.84	+.1.4	7	9,777	
Milwaukee	681	122	142	29.26	29.99	+.02	69.8	+.0.6	89	22	78	54	5	62	25	63	59	73	2.14	1.0	8	6,329
Green Bay	617	49	86	29.30	29.96	-.01	69.1	0.9	90	21	79	49	7	59	51	62	58	71	3.59	+.0.2	11	5,984
Duluth	1,133	11	47	28.76	29.95	-.00	65.0	+.0.3	89	21	74	46	6	56	26	59	56	75	0.97	2.8	11	7,765
<i>North Dakota.</i>							<b>67.9</b>	<b>-0.7</b>														
Moorhead	940	8	57	28.97	29.98	+.04	67.5	0.1	90	11	78	48	1	56	30	62	60	80	3.46	-.0.4	13	4,410
Bismarck	1,674	15	57	28.24	30.00	+.07	68.2	-1.3	91	21	80	46	17	56	38	60	56	70	1.15	-1.2	9	6,469
Devils Lake	1,482	11	44	28.42	29.97	+.04	66.0	.....	94	20	79	42	17	53	37	60	56	73	1.24	.....	12	6,918
Williston	1,875	14	44																			
<i>Upper Miss. Valley.</i>							<b>72.7</b>	<b>-2.1</b>														
Minneapolis	102	208					70.8	0.8	91	21	80	54	16	62	24	.....	68	2.33	-1.5	11	7,410	
St. Paul	837	171	179	29.08	29.97	+.02	70.4	-1.1	91	21	80	52	17	61	24	62	58	69	2.57	-.0.8	13	6,191
La Crosse	714	71	87	29.21	29.96	-.00	71.8	-1.1	91	21	82	53	6	62	28	.....	3.17	-.0.9	11	4,007		
Madison	974	70	78	28.94	29.96	-.01	69.8	-2.6	89	21	79	53	5	61	24	62	58	68	1.80	-2.3	10	4,965
Charles City	1,015	8	58	28.98	29.98	+.02	68.6	-5.4	90	12	80	49	16	57	31	63	61	80	5.08	+.1.2	12	3,410
Davenport	606	71	79	29.32	29.97	-.00	73.5	0.5	94	21	84	54	16	63	25	65	60	66	2.26	-1.4	3	3,981
Des Moines	861	84	101	29.10	29.99	+.03	71.4	-3.1	91	21	82	52	24	61	32	64	59	69	2.67	-.0.9	12	4,074
Dubuque	698	100	117	29.25	29.99	+.02	72.2	-2.1	91	21	82	54	16	62	26	63	58	65	1.57	-2.7	8	3,674
Keokuk	614	64	78	29.32	29.99	+.01	74.6	-2.3	97	22	86	57	16	64	31	55	59	64	1.46	-2.6	6	3,931
Cairo	356	87	93	29.59	29.96	-.04	76.7	-2.2	91	1	85	63	4	69	21	69	66	76	3.86	+.0.4	8	4,367
La Salle	536	56	64	29.41	29.98	+.01	73.2	0.5	92	22	85	51	7	61	30	.....	2.62	.....	10	3,869		
Peoria	609	11	45	29.32	29.98	-.00	72.6	.....	95	22	85	51	24	60	34	64	60	68	2.48	9	4,146	
Springfield, Ill.	644	10	92	29.28	29.95	-.02	75.4	-0.6	96	22	87	55	7	64	31	64	58	61	0.93	1.8	8	4,882
Hannibal	534	75	109	29.40	29.97	-.01	73.9	-2.8	97	22	85	54	8	63	33	.....	0.90	-3.6	6	4,843		
St. Louis	567	208	217	29.36	29.96	-.03	76.5	-2.8	93	22	85	61	7	68	23	66	61	62	0.98	-2.8	6	6,022
<i>Missouri Valley.</i>							<b>72.4</b>	<b>-2.8</b>														
Columbia, Mo.	784	11	84	29.15	29.96	-.02	74.6	-1.8	95	22	86	57	25	63	34	.....	67	2.35	-1.3	11	4,153	
Kansas City	963	78	95	29.00	30.01	+.04	75.5	-0.2	90	21	85	60	16	66	25	62	68	3.24	1.0	9	4,088	
Springfield, Mo.	1,324	98	104	28.60	29.98	0.00	72.8	-2.9	89	21	82	57	3	64	25	66	63	77	6.39	+.2.1	11	4,957
Iola	984	40	47	28.96	29.98	+.01	74.7	.....	94	22	85	59	3	64	27	.....	5.60	.....	8	3,731		
Topeka	85	89					74.8	-2.6	93	21	86	57	16	64	29	.....	2.56	-.2.4	9	4,580		
Lincoln	1,189	11	84	28.75	29.98	+.03	72.4	-4.4	90	21	84	54	7	61	30	64	60	71	6.85	+.3.0	9	5,051
Omaha	1,105	115	121	28.84	30.00	+.05	72.6	-3.6	90	21	87	57	17	64	24	64	59	67	2.85	1.9	9	4,539
Valentine	2,598	47	54	27.34	30.02	+.09	69.8	-3.5	97	21	83	47	17	56	39	59	52	61	1.88	0.6	6	3,736
Sioux City	1,135	96	164	28.80	29.99	+.04	70.4	-3.9	89	10	81	52	30	59	34	.....	2.37	-.1.0	8	6,306		
Pierre	1,572	43	50	28.35	29.98	+.05	73.8	-0.8	104	21	86	50	17	61	36	61	54	56	1.02	-1.2	5	5,128
Huron	1,306	56	67	28.62	30.00	+.06	69.0	-1.9	92	21	82	47	15	56	36	62	58	71	1.90	-1.2	10	6,710
Yankton	1,233	49	57	28.69	29.98	+.04	70.2	-3.4	91	21	82	50	23	59	33	.....	2.11	1.7	8	4,159		
<i>Northern Slope.</i>							<b>65.7</b>	<b>-0.7</b>														
Havre	2,505	11	44	27.39	29.97	+.06	70.2	+.2.7	94	23	85	41	15	55	39	59	52	58	0.17	2.0	2	5,217
Miles City	2,371	26																				

TABLE I.—*Climatological data for U. S. Weather Bureau stations, July, 1908—Continued.*

Stations.	Elevation of instruments.		Pressure, in inches.		Temperature of the air, in degrees Fahrenheit.										Precipitation, in inches.		Wind.					
	Barometer above sea level, feet.		Thermometers above ground.		Temperature of the air, in degrees Fahrenheit.					Mean wet thermometer.			Precipitation, in inches.		Wind.							
	Thermometer above ground.	Anerometer above ground.	Sea level, reduced to mean of 24 hrs.	Actual, reduced to mean of 24 hours.	Departure from normal.	Mean max. + mean min. + $\pm$	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Total.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total movement, miles.	Prevailing direction.	Miles per hour.	Maximum velocity.	
<i>Mid. Pac. Coast Reg.</i>																						
Eureka . . . . .	62	62	80	29.96	30.03	— .02	65.8	+ 1.4		65.0	+ 0.2	66	2 50	50	12	53	14	53	65	0.02	— 0.1	
Mount Tamalpais . . . . .	2,375	11	18	29.39	29.90	—	53.2	— 0.6	73	1 57	47	25	49	25	0.00	— 0.3	0.01	1	4,248	nw	24	
Point Reyes Light . . . . .	490	7	18	29.39	29.90	—	53.2	+ 3.9	110	24	102	60	21	69	39	65	52	40	T	0.0	17,831	
Red Bluff . . . . .	332	50	56	29.48	29.81	— .08	65.7	+ 4.0	104	24	92	53	28	61	40	64	57	58	0.00	0.0	2,841	
Sacramento . . . . .	69105	117	29	29.77	29.84	— .04	76.6	+ 4.0	104	24	92	49	31	51	31	54	52	88	0.08	+ 0.1	5,784	
San Francisco . . . . .	237	29	42	29.77	29.94	— .01	57.6	— 0.7	82	1 64	49	31	51	31	54	52	88	0.08	+ 0.1	4	6,874	
San Jose . . . . .	141	78	88	29.77	29.92	—	68.6	— 0.6	98	2 84	46	18	54	45	—	—	—	—	0	w.	22	
Southeast Farallon. . . . .	30	9	17	29.92	29.95	—	53.2	—	62	2 56	47	26	51	11	—	—	—	—	0.00	0	12,594	
<i>S. Pac. Coast Reg.</i>																						
Fresno . . . . .	330	67	70	29.49	29.53	— .00	86.0	+ 4.5	111	24	104	59	28	68	41	61	42	28	T.	0.0	0	
Los Angeles . . . . .	338116	123	29.54	29.89	— .01	72.2	+ 2.9	94	25	83	55	21	28	64	61	79	70	0.02	0.0	1	4,868	
San Diego . . . . .	87	94	102	29.80	29.89	— .03	68.7	+ 1.6	82	25	73	58	2	64	14	64	62	83	T.	0.0	3,941	
San Luis Obispo . . . . .	201	47	54	29.71	29.93	— .02	64.6	— 0.1	87	5 79	44	11	50	39	56	52	74	74	T.	0.0	0	
<i>West Indies.</i>																						
Grand Turk . . . . .	11	6	20	30.02	30.04	+ .02	83.3	—	92	25	90	72	13	77	—	6.62	—	11	e.	—	14,29	
San Juan . . . . .	82	48	90	29.92	30.00	+ .01	80.0	— 1.3	87	25	85	71	6	75	13	75	73	78	7.77	+ 2.0	21	9,325
<i>Panama.</i>																			e.	40	se.	
Ancon . . . . .	74	—	—	29.74	29.82	—	80.2	—	92	5 87	71	27	74	18	75	75	92	9.01	—	19	0	
Naos . . . . .	40	—	—	29.78	29.82	—	79.8	—	92	5 86	71	24	74	20	75	75	92	8.79	—	17	5,066	
																		nw.	40	ne.	24	

\*More than one date.

TABLE II.—*Climatological record of cooperative observers, July, 1906.*

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.			Stations.	Temperature. (Fahrenheit.)			Precipita- tion.			Stations.	Temperature. (Fahrenheit.)			Precipita- tion.					
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.			
Alabama.	°	°	°	Inz.	Inz.	Alabama—Cont'd.	°	°	°	Inz.	Inz.	Arizona—Cont'd.	°	°	°	Inz.	Inz.	Arizona—Cont'd.	°	°	°	Inz.	Inz.
Alaga.	94	62	76.2	12.44	6.72	Valleyhead	93	57	74.8	6.62	8.29	Prescott	99	45	73.4	4.21	4.21	Prescott	99	45	73.4	4.21	4.21
Ashville.	93	66	77.7	10.43	7.76	Vienna	99	64	80.4	5.46	8.29	Quakingasp	85	57	73.4	2.50	2.50	Quakingasp	85	57	73.4	2.50	2.50
Auburn.	97	63	77.8	8.15	8.21	Wetumpka	79	33	54.8	1.78	8.29	Roosevelt	114	64	89.6	0.35	0.35	Roosevelt	114	64	89.6	0.35	0.35
Benton.	100	61	80.4	5.19	5.19	Alaska.	83	28	53.0	3.25	8.29	St. Johns.	96	47	72.4	2.71	2.71	St. Johns.	96	47	72.4	2.71	2.71
Bermuda	97	63	77.8	8.15	8.21	Chestochena	82	40	58.7	4.99	8.29	St. Michaels	94	41	68.6	1.13	1.13	St. Michaels	94	41	68.6	1.13	1.13
Boligee.	95	68	76.2	9.05	9.05	Ketchemstock	82	34	56.3	2.69	8.29	San Carlos.	109	57	85.8	2.01	2.01	San Carlos.	109	57	85.8	2.01	2.01
Bridgeport.	95	68	76.2	9.05	9.05	Loring	72	40	54.9	7.45	8.29	San Simon.	105	58	81.4	0.80	0.80	San Simon.	105	58	81.4	0.80	0.80
Burkeville.	95	68	76.2	9.05	9.05	North Fork	80	28	52.2	2.70	8.29	Seligman.	97	46	73.4	3.09	3.09	Seligman.	97	46	73.4	3.09	3.09
Calera.	95	68	76.2	9.05	9.05	Sitka	72	42	55.4	4.70	8.29	Sentinel*1	115	85	97.9	0.06	0.06	Sentinel*1	115	85	97.9	0.06	0.06
Camp Hill.	99	64	78.2	11.24	11.24	Tiekhill	80	28	52.2	2.70	8.29	Signal.	111	63	90.2	0.49	0.49	Signal.	111	63	90.2	0.49	0.49
Cedar Bluff.	95	68	80.0	6.71	11.16	Wood Island	72	42	55.4	4.70	8.29	Silver Bell.	109	67	87.0	1.98	1.98	Silver Bell.	109	67	87.0	1.98	1.98
Citronelle.	95	68	80.0	6.71	6.71	Allaire Ranch	.....	.....	.....	3.16	8.29	Tempe.	115	57	90.6	0.24	0.24	Tempe.	115	57	90.6	0.24	0.24
Clanton.	95	68	78.0	12.48	12.48	Alpine	.....	.....	.....	2.47	8.29	Thatcher.	107	51	81.6	1.27	1.27	Thatcher.	107	51	81.6	1.27	1.27
Cordova.	99	60	77.4	7.22	10.55	Arizona Canal Co. Dam.	113	69	92.4	1.62	8.29	Tombstone.	100	50	77.4	2.77	2.77	Tombstone.	100	50	77.4	2.77	2.77
Dadeville.	95	70	80.8	10.50	10.50	Aztec	115	72	94.6	T.	8.29	Tuba.	101	54	76.7	1.73	1.73	Tuba.	101	54	76.7	1.73	1.73
Daphne.	95	70	80.8	10.50	10.50	Benson.	105	59	80.9	2.39	8.29	Tucson.	108	61	86.2	1.82	1.82	Tucson.	108	61	86.2	1.82	1.82
Decatur.	100	60	79.2	9.21	9.21	Bisbee.	92	56	72.7	4.86	8.29	Upper San Pedro.	101	46	77.4	0.26	0.26	Upper San Pedro.	101	46	77.4	0.26	0.26
Demopolis.	95	68	78.4	8.28	8.28	Blue	105	44	70.7	3.75	8.29	Vail*1.	105	70	84.0	0.71	0.71	Vail*1.	105	70	84.0	0.71	0.71
Eufaula.	93	67	78.4	6.14	6.14	Bonita.	.....	.....	.....	2.05	8.29	Walnut Grove.	.....	.....	.....	3.40	3.40	Walnut Grove.	.....	.....	.....	3.40	3.40
Evergreen.	95	65	80.7	7.25	7.25	Bowie	108	54	81.7	1.45	8.29	Willcox.	106	57	79.4	2.50	2.50	Willcox.	106	57	79.4	2.50	2.50
Flomaton.	99	64	82.0	10.20	10.20	Buckeye	112	56	89.2	0.24	8.29	Williams.	87	39	63.2	4.82	4.82	Williams.	87	39	63.2	4.82	4.82
Florence.	95	58	77.2	8.94	8.94	Casagrande	119	71	96.8	1.18	8.29	Yarnell.	.....	.....	.....	3.92	3.92	Yarnell.	.....	.....	.....	3.92	3.92
Fort Deposit.	96	60	78.6	7.56	7.56	Chiarsons Mills.	91	36	58.4	4.44	8.29	Young.	.....	.....	.....	2.87	2.87	Young.	.....	.....	.....	2.87	2.87
Gadsden.	97	65	78.4	11.78	11.78	Clifton	.....	.....	.....	1.11	8.29	Arkansas.	.....	.....	.....	.....	.....	Arkansas.	.....	.....	.....	.....	.....
Goodwater.	99	65	79.6	6.53	6.53	Cline	106	58	85.1	1.25	8.29	Alicia.	93	58	76.0	7.59	7.59	Alicia.	93	58	76.0	7.59	7.59
Greensboro.	96	67	80.3	5.05	5.05	Cochise*1.	107	67	81.4	1.22	8.29	Amity.	92	58	76.0	7.25	7.25	Amity.	92	58	76.0	7.25	7.25
Greenville.	95	68	80.3	4.80	4.80	Congress	104	63	85.6	2.81	8.29	Arkadelphia.	96	60	78.2	8.45	8.45	Arkadelphia.	96	60	78.2	8.45	8.45
Guntersville.	95	68	80.3	10.52	10.52	Douglas.	104	58	80.2	1.72	8.29	Arkansas City.	.....	.....	.....	12.95	12.95	Arkansas City.	.....	.....	.....	12.95	12.95
Hamilton.	100	57	78.0	6.88	6.88	Dudleyville	104	59	82.7	3.89	8.29	Arnett.	88	52	71.6	3.94	3.94	Arnett.	88	52	71.6	3.94	3.94
Highland Home.	97	60	79.1	7.08	7.08	Duncan	105	52	78.7	2.50	8.29	Batesville.	98	58	76.9	3.08	3.08	Batesville.	98	58	76.9	3.08	3.08
Leothatchie.	95	68	80.2	4.00	4.00	Fish Creek	.....	.....	.....	2.45	8.29	Beebranch.	92	55	74.5	2.85	2.85	Beebranch.	92	55	74.5	2.85	2.85
Livingston.	97	64	80.2	5.09	5.09	Fort Apache.	96	48	73.4	2.46	8.29	Black Rock.	.....	.....	.....	2.12	2.12	Black Rock.	.....	.....	.....	2.12	2.12
Lock No. 4.	98	62	77.4	11.16	11.16	Fort Huachua.	99	54	76.7	2.97	8.29	Boonville.	97	57	77.0	6.96	6.96	Boonville.	97	57	77.0	6.96	6.96
Lucy.	97	63	80.1	8.51	8.51	Fort Mohave.	122	67	95.4	0.52	8.29	Brinkley.	99	58	79.2	6.96	6.96	Brinkley.	99	58	79.2	6.96	6.96
Madison Station.	99	60	78.0	5.76	5.76	Fredonia.	100	47	76.8	1.42	8.29	Calico Rock.	.....	.....	.....	2.80	2.80	Calico Rock.	.....	.....	.....	2.80	2.80
Maple Grove.	99	61	77.1	14.11	14.11	Grand Canyon.	96	35	65.8	0.70	8.29	Camden.	93	60	77.5	10.10	10.10	Camden.	93	60	77.5	10.10	10.10
Marion.	99	67	83.2	7.04	7.04	Greaterville.	96	55	74.5	3.06	8.29	Center Point.	97	61	79.3	10.11	10.11	Center Point.	97	61	79.3	10.11	10.11
Milstead.	95	68	80.4	8.04	8.04	Greer.	.....	.....	.....	4.31	8.29	Clarendon.	.....	.....	.....	7.05	7.05	Clarendon.	.....	.....	.....	7.05	7.05
Newbern.	100	64	80.3	4.82	4.82	Holbrook.	102	47	76.8	1.11	8.29	Conway.	94	59	77.1	2.93	2.93	Conway.	94	59	77.1	2.93	2.93
Notasulga.	98	57	76.6	11.70	11.70	Huachua Res.	.....	.....	.....	4.61	8.29	Cornerstone.	95	59	78.2	5.50	5.50	Cornerstone.	95	59	78.2	5.50	5.50
Oneonta.	98	57	76.6	12.71	12.71	Intake Dam.	.....	.....	.....	0.52	8.29	Corning.	93	59	76.1	5.93	5.93	Corning.	93	59	76.1	5.93	5.93
Opelika.	100	63	79.2	8.61	8.61	Jerome.	99	60	81.0	1.00	8.29	Dardanelle.	.....	.....	.....	6.58	6.58	Dardanelle.	.....	.....	.....	6.58	6.58
Ozark.	95	65	79.6	9.71	9.71	Keams Canyon.	101	43	73.8	1.61	8.29	Des Arc.	95	60	78.0	6.20	6.20	Des Arc.	95	60	78.0	6.20	6.20
Prattville.	96	63	79.6	6.55	6.55	Kingman.	105	64	84.7	2.18	8.29	Dodd City.	99	54	74.6	2.30	2.30	Dodd City.	99	54	74.6	2.30	2.30
Pushmataha.	97	63	80.9	5.37	5.37	Maricopa.	115	63	93.2	0.28	8.29	Dutton.	86	54	70.5	3.08	3.08	Dutton.	86	54	70.5	3.08	3.08
Riverton.	95	65	75.6	10.88	10.88	Mesa.	114	60	91.2	0.54	8.29	Eldorado.	95	58	79.6	7.67	7.67	Eldorado.	95	58	79.6	7.67	7.67
Scootaboro.	92	61	75.6	10.71	10.71	Mohawk Summit*1	117	84	97.3	0.00	8.29	Eureka Springs.	92	52	73.6	3.66	3.66	Eureka Springs.	92	52	73.6	3.66	3.66
Elema.	99	65	82.2	4.69	4.69	Natural Bridge.	.....	.....	.....	2.56	8.29	Fayetteville.	92	57	74.0	5.88	5.88	Fayetteville.	92	57	74.0	5.88	5.88
Falladega.	99	62	78.4	10.86	10.86	Nutriomo.	.....	.....	.....	3.05	8.29	Forrest City.	92	60	76.6	8.67	8.67	Forrest City.	92	60	76.6	8.67	8.67
Fallassee.	.....	.....	.....	8.34	8.34	Oracle.	98	60	80.2	1.85	8.29	Fulton.	.....	.....	.....	6.94	6.94	Fulton.	.....	.....	.....	6.94	6.94
Thomasville.	97	68	80.7	3.25	3.25	Parker.	118	63	94.6	0.06	8.29	Hardy.	93	59	75.5	4.22	4.22	Hardy.	93	59	75.5	4.22	4.22
Fuscaloosa.	97	64	79.4	6.71	6.71	Phoenix (Ex. Farm).	111	60	89.8	0.06	8.29	Harrison.	97	51	72.4	4.52	4.52	Harrison.	97	51	72.4	4.52	4.52
Tuscaloosa.	96	63	78.2	5.67	5.67	Pitacho*1.	110	60	90.0	1.54	8.29	Heber.	97	54	76.4	2.85	2.85	Heber.	97	54	76.4	2.85	2.85
Tuskegee.	98	62	80.1	8.53	8.53	Pinal Ranch.	.....	.....	.....	5.33	8.29	Helena.	94	61	78.6	9.44	9.44	Helena.	94	61	78.6	9.44	9.44
Union Springs.	97	66	79.7	9.81	9.81	Pinto.	.....	.....	.....	0.53	8.29	Hope.	98	61	80.0	10.15	10.15	Hope.	98	61	80.0	10.15	10.15
Montgomery.	100	65	80.5	4.83	4.83	.....	.....	.....	.....	.....	Jalontown.	98	56	78.2	2.61	2.61	Jalontown.	98	56	78.2	2.61	2.61	

TABLE II.—*Climatological record of cooperative observers—Continued.*

Stations.	Temperature. (Fahrenheit.)			Precipita- tion. Rain and melted snow.	Stations.	Temperature. (Fahrenheit.)			Precipita- tion. Rain and melted snow.	Stations.	Temperature. (Fahrenheit.)			Precipita- tion. Rain and melted snow.	
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.		
<i>Arkansas—Cont'd.</i>	°	°	°	Ins.	<i>California—Cont'd.</i>	°	°	°	Ins.	<i>Colorado—Cont'd.</i>	°	°	°	Ins.	
Lacrosse.....	60	9.97	9.97	Mohave.....	108	70	91.2	0.00	Dunkley °.....	81	33	57.8	.....	.....	
Lake Village.....	93	60	78.4	9.49	Mokelumne Hill.....	101	56	81.3	0.00	Eagle.....	87	36	60.8	0.74	.....
Lewisville.....	99	59	79.4	6.95	Mono Ranch.....	94	51	72.8	0.00	Fort Collins.....	93	41	65.0	1.96	.....
Lutherville.....	91	56	75.4	5.27	Montague.....	106	52	77.4	1.27	Fowler.....	.....	.....	1.59	.....	.....
Malvern.....	94	60	76.0	11.20	Montereo.....	102	50	79.8	0.16	Frances.....	83	35	58.6	4.04	.....
Mammoth Springs.....	92	51	74.8	3.07	Monumental.....	99	45	72.6	0.00	Fruita.....	99	49	73.6	0.26	.....
Marked Tree.....	.....	.....	1.55	Mount St. Helena.....	.....	.....	.....	.....	Garnett.....	86	38	59.4	1.78	.....	
Marvell.....	95	59	78.8	8.08	Napa.....	103	53	70.9	0.00	Gladstone.....	.....	.....	3.35	.....	.....
Mena.....	91	59	75.4	5.14	Needles.....	113	76	96.2	0.59	Gleneyre.....	89	39	62.8	2.09	.....
Montrose.....	96	60	78.9	8.98	Nevada City.....	99	45	73.0	0.00	Glenwood Springs.....	90	39	64.4	0.74	.....
Mosserville.....	88	55	71.0	3.57	Newcastle.....	107	52	82.6	0.00	Gothic.....	79	32	52.6	1.20	.....
Mount Nebo.....	83	60	71.4	5.10	Newman.....	114	54	85.5	0.00	Grand Valley.....	98	44	71.2	1.74	.....
Newport.....	99	59	78.6	3.72	Niles.....	96	46	69.0	0.00	Greeley.....	93	44	68.4	2.24	.....
Ozark.....	95	48	76.6	4.81	Nimshew.....	101	71	86.6	0.00	Grover.....	.....	.....	1.90	.....	.....
Pinebluff.....	95	61	78.2	7.00	North Bloomfield.....	99	49	74.4	0.00	Gunnison.....	87	35	58.0	1.56	.....
Pocahontas.....	93	55	74.6	4.63	Oakland.....	88	52	63.8	0.00	Hahns Peak.....	79	30	53.3	2.40	.....
Pond.....	91	51	72.2	6.50	Ojai Valley.....	98	50	73.8	0.00	Hamps.....	87	36	64.0	3.09	.....
Prescott.....	99	62	79.8	10.26	Orleans.....	113	54	84.5	0.00	Higbee.....	.....	.....	2.50	.....	.....
Princeton.....	99	55	79.5	9.89	Oroville (near).....	110	55	84.6	0.00	Hoshne.....	94	39	66.2	5.28	.....
Rison <sup>1</sup> .....	94	59	77.6	.....	Palermo.....	111	53	81.2	0.00	Holly.....	98	42	71.7	2.25	.....
Rogers.....	90	56	72.7	2.87	Peachland.....	96	42	65.7	0.00	Holyoke (near).....	99	48	71.0	2.55	.....
Russellville.....	96	60	78.6	6.39	Pine Crest.....	90	52	68.6	T.	Idaho Springs.....	84	39	60.0	2.13	.....
Spielerville.....	94	50	75.0	6.40	Placerville.....	98	50	75.0	0.00	Lake City.....	82	34	56.8	1.83	.....
Stuttgart.....	93	59	77.4	7.03	Point Lobos.....	70	52	59.0	0.00	Lake Moraine.....	70	31	49.4	4.66	.....
Texarkana.....	97	65	80.4	5.36	Porterville.....	109	60	84.5	0.00	Lamar.....	101	46	73.1	2.72	.....
Warren.....	97	58	79.6	8.00	Poway.....	94	50	74.8	T.	Laporte.....	.....	.....	1.66	.....	.....
White Cliffs.....	.....	.....	2.54	Quincy.....	95	40	67.6	0.12	Las Animas.....	101°	45°	74.4°	3.20	.....	
Wiggs.....	98	55	76.0	6.76	Redding.....	104	60	84.0	T.	Lay.....	91	32	64.5	0.45	.....
Winchester.....	97	60	79.5	6.56	Redlands.....	105	59	79.5	0.00	Leroy.....	96	45	67.7	1.88	.....
<i>California.</i>	.....	.....	.....	Reedley.....	113	50	85.7	0.00	Longs Peak.....	75	27	51.0	3.37	.....	
Alturas.....	98	40	70.7	0.01	Repreasa.....	.....	.....	.....	Lujane.....	91	48	69.0	1.35	.....	
Angola.....	112	55	84.2	0.00	Rialto.....	102	58	79.6	T.	Manassa.....	82	38	59.4	0.09	.....
Auburn.....	100	61	84.3	0.00	Rivista.....	104	51	77.1	0.00	Mancos.....	90	41	64.4	2.62	.....
Azusa.....	98	50	75.0	0.01	Riverside.....	100	52	76.5	T.	Meeker.....	90	36	63.4	0.97	.....
Bagdad.....	117	76	99.2	0.00	Rocklin.....	107	53	79.6	0.00	Montrose.....	92	40	65.5	1.01	.....
Bakersfield.....	113	49	83.8	0.00	Rohnerville.....	.....	.....	.....	Moraine.....	80	33	56.9	2.82	.....	
Berkeley.....	86	52	83.4	0.00	Sacramento.....	98	52	74.1	0.00	Pagoda.....	88	31	61.4	1.88	.....
Bishop <sup>10</sup> .....	100 <sup>4</sup>	43 <sup>4</sup>	75.1 <sup>4</sup>	0.01	Salinas.....	91°	49°	65.8°	0.00	Paonia.....	95	47	70.0	1.15	.....
Blacksburg.....	100	44	70.6	0.00	San Bernardino.....	105	53	80.0	T.	Platte Canon.....	.....	.....	2.15	.....	.....
Blue Canyon.....	87	38	65.4	0.00	San Jacinto.....	105	58	82.0	0.52	Power House.....	93	40	60.5	2.95	.....
Branscomb.....	99	42	70.2	0.00	San Leandro.....	93	48	65.8	0.00	Rangley.....	93	40	66.3	0.49	.....
Brush Creek.....	104	46	75.0	0.00	San Miguel Island.....	.....	.....	.....	River Portal.....	93	46	67.6	0.70	.....	
Calexico.....	109	70	91.3	T.	Santa Barbara.....	85	56	67.9	T.	Rockyford.....	98	49	71.8	2.05	.....
Campbell.....	98	43	68.8	0.00	Santa Clara College.....	99	43	69.0	0.00	Saguache.....	88	42	62.4	2.42	.....
Cedarville.....	105	50	75.6	0.18	Santa Cruz.....	95	44	64.9	0.00	Salida.....	88	37	62.4	1.85	.....
Chico.....	110	54	82.2	0.00	Santa Maria.....	85	49	64.7	T.	San Louis.....	88	39	59.2	3.67	.....
Claremont.....	102	57	76.8	0.03	Santa Monica.....	89	52	65.1	0.00	Santa Clara.....	87	39	59.8	4.13	.....
Cloverdale.....	107	49	75.0	0.00	Santa Rosa.....	99	44	67.2	0.00	Sapinero.....	86	35	59.1	2.42	.....
Colfax.....	102	52	76.8	0.00	Shasta.....	112	58	87.8	0.00	Sheridan Lake.....	96	53	73.6	2.78	.....
Colusa.....	104	52	79.4	0.00	Sierra Madre.....	96	57	76.0	0.03	Silt.....	91	46	67.0	1.94	.....
Craftonville.....	.....	.....	0.20	Tulare.....	108	58	83.0	0.00	Silverton.....	80	32	53.6	2.82	.....	
Crescent City.....	69	47	57.3	0.00	Tustin.....	.....	.....	.....	Stonewall.....	.....	.....	7.43	.....	.....	
Cuyamaca.....	82	51	68.8	0.10	Ukiah.....	108	48	76.0	0.00	Sugar City.....	.....	.....	2.68	.....	.....
Delta.....	106	54	81.4	0.00	Upland.....	97	51	76.1	0.11	Terminal Dam.....	.....	.....	3.49	.....	.....
Dimond.....	.....	.....	0.01	Upper Lake.....	105	55	79.4	0.00	Trinidad.....	91	46	67.3	4.58	.....	
Dobbins.....	108	60	83.6	0.00	Upper Mattole.....	.....	.....	.....	Victor.....	80	30	57.0	6.05	.....	
Durham.....	109	52	80.6	0.00	Vacaville.....	109	50	77.4	0.00	Vilas.....	.....	.....	2.25	.....	.....
Elacon.....	100	54	76.2	T.	Visalia.....	111	51	83.4	0.00	Wagon Wheel.....	85	30	55.4	4.60	.....
Electra.....	107	58	83.2	0.00	Wasco.....	111	58	85.6	0.00	Waterdale.....	90	43	65.0	2.86	.....
Elmwood.....	114 <sup>3</sup>	53	86.6 <sup>b</sup>	0.00	Westpoint.....	89	55	70.7	0.00	Westcliffe.....	85	33	59.2	2.14	.....
Elsinore.....	104	52	82.0	0.00	Wheatland.....	107	54	80.2	0.00	Whitepine.....	74	31	51.0	4.80	.....
Emigrant Gap.....	84	62	72.8	0.00	Willets.....	112	41	71.6	0.00	Wray.....	97	46	70.4	1.62	.....
Escondido.....	101	45	76.4	0.00	Woodleaf.....	92	38	65.8	0.00	Yuma.....	.....	.....	2.44	.....	.....
Folsom.....	111	53	82.6	0.00	Zenia.....	94	59	68.3	0.00	<i>Connecticut.</i>	.....	.....	.....	.....	.....
Fordyce.....	.....	.....	0.20	Akron.....	.....	.....									

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Florida—Cont'd.</i>																	
Clermont	97	71	82.4	7.61	Inz.	Rome	95	62	77.6	7.36	Inz.	Hillsboro	98	53	75.4	0.50	Inz.
De Funka	97	60	80.1	7.43		St. George	95	65	79.6	4.88		Hooperston	93	50	73.2	2.34	
Eustis	96	69	80.9	7.52		St. Marys	95	69	80.9	20.03		Joliet	95	52	73.2	2.51	
Federal Point	96	70	81.2	9.20		Sereven	94	68	81.0	10.02		Kishwaukee	93	45	71.7	2.99	
Fernandina	94	70	80.7	14.59		Statesboro	96	62	79.8	8.53		Knoxville	95	48	71.8	3.08	
Fort Meade	99	70	81.6	10.59		Talbotton	95	62	78.1	5.89		Lagrange	99	51	73.2	2.16	
Fort Myers	91	72	80.2	9.69		Tallapoosa	96	64	78.2	9.05		Laharpe	98	48	72.4	4.25	
Fort Pierce	93	69	80.6	6.04		Toccoa	92	62	73.0	14.70		Lanark	92	44	70.7	4.32	
Gainesville	95	62	81.2	10.28		Valdosta	97	66	80.0	5.11		Lincoln	98	56	75.8	0.61	
Galt	69	—	—	8.10		Valona	92	68	78.4	6.53		Loami	—	—	—	6.97	
Grasmere	96	73	82.6	—		Vidalia	93	69	80.8	9.27		McLeansboro	95	57	75.9	1.92	
Huntington	95	69	81.2	13.23		Washington	95	64	76.4	9.86		Martinsville	95	52	74.6	2.74	
Hypoixo	94	71	81.8	7.31		Waycross	94	68	81.3	9.01		Martinton	97	50	72.6	6.02	
Inverness	92	68	80.0	14.87		Waynesboro	94	65	79.5	4.68		Mascoutah	96	54	75.1	0.90	
Jasper	92	69	80.2	9.71		Westpoint	95	65	77.7	8.12		Minonk	96	51	73.8	1.66	
Johnstown	94	64	80.6	9.93		Woodbury	98	62	77.5	11.74		Monmouth	98	50	73.6	2.73	
Kissimmee	93	62	81.6	6.65		<i>Idaho.</i>						Morrison	94	48	70.5	4.10	
Lake City	93	70	80.6	15.92		American Falls	98	44	70.6	0.40		Morrisonville	93	51	73.2	1.87	
Macclenny	96	68	80.8	9.39		Bannock River Cabin	91	37	66.0	0.07		Mount Carmel	—	—	—	2.96	
Malabar	94	68	81.6	7.70		Blackfoot	96	42	68.1	0.17		Mount Vernon	99	52	76.6	1.07	
Manatee	93	70	81.0	7.50		Buhl	101	54	77.2	T		New Burnside	94	54	76.5	4.76	
Marianna	99	67	81.2	7.42		Caldwell	101	48	76.8	T		Olney	96	49	75.4	3.97	
Merritt Island	90	71	81.2	9.54		Cambridge	105	45	77.4	0.04		Ottawa	97	51	73.1	1.45	
Miami	92	69	81.8	9.26		Chesterfield	94	36	65.9	0.07		Palestine	100	53	75.4	3.56	
Molino	97	63	79.4	7.99		Dent	—	—	—	—		Pana	92	54	74.2	0.89	
Monticello	92	67	79.9	8.90		Dewey	90	42	66.8	0.03		Paris	95	49	74.4	2.95	
Mount Pleasant	98	67	81.2	4.86		Ellerslie	98	46	74.4	0.00		Philo	93	56	72.1	4.87	
New Smyrna	94	69	81.2	7.31		Fernwood	—	—	—	—		Pontiac	95	52	74.8	2.39	
Ocala	95	68	81.0	15.42		Forney	96	34	64.4	0.54		Rantoul	98	52	74.6	3.49	
Orange City	89	—	—	6.74		Garnett	108	52	82.8	T		Raum	94	57	76.0	2.74	
Orange Home	94	69	80.7	8.42		Grangeville	95	48	71.5	0.01		Riley	95	50	71.5	1.25	
Orlando	95	70	82.5	5.65		Hot Springs	104	54	77.8	0.15		Robinson	93	52	74.4	2.81	
Rockwell	92 <sup>a</sup>	69 <sup>a</sup>	82.4 <sup>a</sup>	12.35		Idaho Falls	93	43	67.3	0.27		Rockford	95	48	72.8	3.91	
St. Andrews	94	70	81.8	9.08		Johnsons	91	38	64.4	0.29		Rushville	97	53	74.0	2.52	
St. Augustine	92	69	80.0	9.33		Kellogg	95	43	69.4	0.12		St. Charles	99	49	72.2	0.74	
St. Leo	93	70	80.2	15.19		Lake	83	34	58.4	0.50		St. John	95	55	76.0	3.37	
Stephenville	96	—	—	14.14		Lakeview	97	48	71.3	0.00		Streator	99	43	72.5	1.39	
Switzerland	92 <sup>a</sup>	70 <sup>a</sup>	80.2 <sup>a</sup>	11.20		Landore	90	39	64.8	0.06		Sullivan	97	51	74.4	1.76	
Tallahassee	92	67	79.8	8.88		Lardo	91	35	63.8	T		Sycamore	96	47	71.8	1.36	
Tarpon Springs	93	69	80.1	11.73		Lost River	89	42	65.4	0.27		Tilden	95	50	75.0	1.72	
Titusville	96	67	80.9	9.21		Lovell	100	36	67.7	0.00		Tiskilwa	94	49	72.2	2.14	
Wausau	98	63	81.4	9.16		Meadows	100	35	67.6	0.00		Tuscola	93	51	73.3	4.09	
<i>Georgia.</i>						Minilka	102	50	74.4	T		Urbana	92	52	73.2	2.16	
Abbeville				6.73		Minidoka	102	49	74.0	0.22		Vernon	96	50	75.2	1.00	
Adairsville	91	62	76.0	10.32		Moscow	99	51	74.6	0.03		Walnut	93	49	73.6	1.68	
Albany	96	62	82.2	8.34		Mountain Home	104	43	76.0	T		Warsaw	—	—	—	2.11	
Americus	95	66	79.8	4.57		Murray	97	40	67.8	0.00		Windsor	96	50	73.6	1.34	
Athens	93	65	76.0	9.30		Nevens Ranch	—	—	—	—		Winnebago	91	48	70.8	2.83	
Bainbridge	94	67	82.0	8.92		Ola	102	44	71.8	0.00		Yorkville	97	47	72.0	1.61	
Blakely	100	—	—	8.04		Orofino	109	42	74.8	0.00		Zion	93	46	70.0	3.19	
Bowersville	98	65	76.8	6.72		Pearl	—	—	—	—		<i>Indiana.</i>					
Brunswick	97	69	81.6	13.14		Pollock	105	50	77.4	0.00		Anderson	90	52	73.0	1.14	
Butler				10.55		Porthill	94	46	71.4	0.22		Angola	93	50	71.4	3.81	
Camak	95	62	76.6	6.92		Roosevelt	83	37	61.1	T		Auburn	92	49	70.2	3.46	
Carlton	95	62	76.6	8.59		St. Maries	100	44	73.3	0.15		Bedford	93	56	76.8	2.10	
Carrollton	93	62	75.6	5.67		Salem	97	40	69.1	0.36		Bloomington	91	57	75.1	2.30	
Clayton	90	57	72.0	14.50		Salmon	96	47	71.7	1.65		Butterville	95	52	74.8	2.68	
Columbus	95	67	80.6	10.36		Standrod	101	44	73.8	0.09		Cambridge City	92	49	72.5	2.55	
Cordele	94	61	78.1	8.53		Twin Falls	101	44	73.8	0.09		Columbus	96	52	74.8	2.71	
Covington				8.10		Vernon	98	41	65.4	0.75		Connerville	93	50	73.2	4.31	
Dahlonega	90	58	72.4	8.83		Westlake	98	41	65.4	0.21		Crawfordsville	94	50	73.8	2.38	
Dawson	98	66	80.8	4.30		Weston	96	42	69.6	0.62		Delphi	93	48	72.2	5.10	
Diamond	87	56	71.8	10.84		<i>Illinois.</i>											

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Indiana—Cont'd.</i>	0	0	0	Ins.	Ins.	<i>Indiana—Cont'd.</i>	0	0	0	Ins.	Ins.	<i>Kansas—Cont'd.</i>	0	0	0	Ins.	Ins.
Shelbyville	92	53	73.6	3.44		Larrabee	96	48	71.8	0.98		Independence	96	58	76.9	5.82	
South Bend	94	51	71.4	3.56		LeClaire	96	49	73.2	3.87		Jetmore	96	49	73.2	3.87	
Syracuse	96	50	72.8	3.77		Lemars	91	48	69.3	1.20		La Crosse	99	51	73.4	2.58	
Terre Haute	94	56	75.4	3.28		Lenox	89	52	71.2	4.14		Lakin	93	46	70.3	5.91	
Veedersburg	92	50	72.4	2.40		Leon	92	51	72.1	2.03		Larned	96	48	71.2	4.30	
Vevay	92	57	77.8	7.95		Little Sioux	91	48	71.0	6.84		Lebanon	93	58	72.4	3.20	
Vincennes	96	56	76.1	3.28		Logan	94	49	71.1	6.95		Lebo	91	53	73.5	3.50	
Washington	94	50	75.2	2.01		Maple Valley	94	46	70.6	2.51		Lindsborg	96	49	72.4	2.65	
Worthington	93	54	74.8	3.75		Marshalltown	94	46	70.6	3.57		Macksville	96	51	74.9	4.71	
<i>Indian Territory</i>						Mason City	91	50	71.5	6.73		McPherson	97	51	75.8	3.38	
Ardmore	99	58	77.8	5.52		Massena	96	48	71.9	3.36		Manhattan b.	96	55	75.8	5.28	
Calvin						Mountay	96	52	73.0	2.82		Manhattan c.	95	58	74.2	5.24	
Durant	99	61	78.4	6.94		Mount Pleasant	97	51	73.6	1.89		Medicine Lodge	99	54	75.4	5.81	
Fairland	93	57	75.2	3.70		Mount Vernon	98	51	73.2	0.93		Minneapolis	95	51	74.4	2.80	
Fort Gibson						Muscatine						Moran	94	55	74.6	6.28	
Hartshorne	93	60	76.3	6.62		Nevada						Mounthope				5.08	
Holdinton	100	53	76.6	5.44		New Hampton	89	48	68.8	3.31		Neosho Rapids				4.98	
Holdenville	95	50	76.5	3.05		Newton	91	54	71.7	5.27		Ness City	99	50	74.4	5.72	
Janes						Northwood	90	47	68.9	3.65		Newton	95	52	74.5	2.48	
Marlow	100	58	76.8	4.86		Odebol	97	46	72.2	1.52		Norton	98	49	71.2	3.54	
Muskogee	95	60	76.0	5.61		Olin	93	50	71.2	3.89		Norwich	94	57	75.1	5.70	
Oklmulgee	97	59	77.6	6.28		Onawa	90	53	71.4	3.60		Oberlin				1.71	
Pauls Valley	99	64	76.2	6.00		Osage	92	47	69.2	5.97		Olathe	93	56	73.4	6.21	
Ravia	99	60	78.0	4.55		Oskaloosa	92	49	71.0	2.33		Osage City	96	55	74.7	4.61	
South McAlester	99	60	78.5	5.58		Ottumwa	94	53	73.4	1.32		Oswego	93	57	74.8	4.61	
Tulsa	94	59	76.4	7.66		Pacific Junction	90	50	70.2	5.05		Ottawa	93	58	72.8	5.02	
Vinita	95°	50°	75.2°	3.87		Pella	95	52	73.4	3.19		Pittsburg	97	57	75.8	4.10	
Wagoner	93	58	75.8	6.41		Perry	95	50	71.8	2.77		Plainville				5.15	
Webbers Falls	97	56	76.4	4.38		Plover	93	47	70.0	3.32		Pleasanton	91	57	73.6	2.98	
<i>Iowa</i>						Pocahontas	94	48	70.7	1.69		Republic	95	50	73.2	2.31	
Afton	97	50	73.0	1.76		Preston	93	46	69.3	2.97		Rome	94	55	74.4	7.25	
Albia	91	51	71.4	3.91		Ridgeway	93	49	72.1	3.58		Russell	97	51	73.6	3.08	
Algona	91	46	70.0	2.05		Rock Rapids	92	46	70.6	0.92		Salina	96	52	74.3	4.10	
Allerton	95	49	72.4	1.79		Rockwell	98	45	72.4	1.38		Scott	94	46	71.9	3.07	
Alta	92	49	69.8	2.12		Sac City	92	48	68.8	0.99		Sedan	92	57	74.7	7.06	
Alton	89	45	68.6	1.80		St. Charles	91	54	71.4	3.82		Toronto	95	53	73.6	7.42	
Ames	92	47	71.4	2.02		Sheldon	94	47	71.1	1.52		Ulysses	101	47	74.7	7.91	
Atlantic	102	45	70.4	3.91		Sibley	91	46	67.1	0.98		Valley Falls	90	54	72.8	3.74	
Audubon	94	44	69.1	2.86		Sigourney	94	50	72.6	2.49		Wakeeney	94	50	72.5	4.53	
Baxter	90	46	70.2	2.79		Sioux Center	89	46	68.5	2.04		Wakeeney (near)				5.21	
Belleplaine	91	48	71.2	4.01		Stockport	94	51	72.2	2.06		Wallace	95	42	69.9	3.88	
Bonaparte	98	50	72.9	2.81		Thurman	92	47	71.4	3.88		Walnut	95	57	75.7	6.23	
Boone	91	52	71.6	3.54		Tipton	96	55	75.8	0.26		Wamego*	90	58	73.6	3.95	
Britt	92	46	69.6	4.73		Toledo	91	48	71.1	3.66		Winfield	94	56	74.5	6.56	
Buckingham						Wapello	91	54	72.2	1.72		Yates Center	96	55	75.0	9.46	
Burlington						Washington	92	52	72.0	3.19		<i>Kentucky</i>					
Carroll	95	54	73.6	2.26		Washta	94	42	68.9	1.16		Alpha	87	56	73.0	6.70	
Cedar Falls						Waterloo	94	49	71.0	3.01		Anchorage	94	54	74.6	7.90	
Cedar Rapids	95	51	72.9	1.97		Waukeee	92	52	71.4	4.93		Bardstown	95	55	76.8	3.46	
Chariton	94	49	70.6	1.56		Waverly	89	49	69.6	3.78		Beattyville	96	53	74.8	4.98	
Clarinda	98	49	72.0	3.44		Webster City	99	45	71.7	2.31		Beaver Dam	93	53	75.4	6.54	
Clearlake	92	51	71.2	4.20		Westbend	94	47	69.6	2.17		Berea	93	52	75.4	3.10	
Clinton	94	49	72.3	5.42		Whitten	93	47	70.2	4.58		Blandville	92	59	76.0	4.60	
College Springs	90	51	71.5	5.95		Wilton Junction						Bowling Green	98	55	76.7	6.22	
Columbus Junction	94	51	71.8	1.27		Winterst	93	53	72.2	5.48		Burnside	93	56	74.4	6.27	
Corning	91	49	70.2	3.63		Woodburn	91	44	69.3	2.29		Cadiz	94	55	76.2	4.11	
Corydon	94	51	72.4	1.03		Zearing	92	45	69.8	3.84		Calhoun	96	56	76.1	5.35	
Creston	93	48	70.4	1.88		Abilene						Catlettsburg	90	54	74.5	4.42	
Cumberland						Alton	96	51	73.2	2.99		Earlington	95	54	75.7	5.97	
Decorah						Anthony						Edmonton	93	55	74.4	6.72	
Delaware	91	49	70.0	3.29		Atchison	93	56	74.6	4.30		Eubank	90	55	73.0	7.53	
Denison	91	44	69.6	1.75		Baker	93	54	74.8	4.07		Falmouth				4.90	
Desoto	90	47	70.4	2.59		Beloit						Farmers	93	51	73.4	7.00	
Dows	91	44	68.														

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.			Rain and melted snow.	Total depth of snow.	Maximum.			Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	
<i>Louisiana—Cont'd.</i>	o	o	o	In.	<i>Massachusetts—Cont'd.</i>	o	o	o	In.	<i>Michigan—Cont'd.</i>	o	o	o	In.	
Clinton	95	65	79.3	5.39	Bedford	85	45	68.4	5.06	Old Mission	93	47	68.2	1.85	
Collinston	98	62	80.4	5.59	Bluehill (summit)	86	52	68.4	6.49	Olivet	90	47	69.2	4.17	
Covington	98	66	81.7	7.35	Cambridge	88	50	71.0	5.37	Omer	88	42	66.9	0.88	
Crowleyville				2.55	Chestnuthill	90	46	71.5	4.13	Onaway	95	40	66.6		
Donaldsonville	98	68	81.0	10.16	Concord	86	42	69.0	5.37	Ovid	95	43	69.8	2.19	
Farmerville	94	64	80.4	7.23	East Templeton*	89	53	72.6	4.90	Owosso	93	44	69.6	4.02	
Franklin	97	65	81.9	13.84	Fallriver	83	51	69.0	4.07	Petoskey	85			1.15	
Grand Coteau	100	66	82.3	10.21	Fitchburg	88	46	70.3	5.37	Plymouth	96	41	68.8	3.03	
Houma	100	67	81.8	11.62	Groton	87	42	68.6	3.99	Pontiac	96	48	69.8	2.26	
Jennings	94	69	81.7	6.25	Lawrence	89	47	71.2	4.90	Powers	95	39	65.0		
Lafayette	94	68	81.2	8.27	Leominster				5.61	Reed City	92	40	68.8	0.80	
Lake Charles	99	63	82.0	11.56	Lowell	89	47	73.0	5.95	Roscommon	86				
Lakeside	93	70	82.2	11.61	Ludlow Center	82	41	66.0	7.68	Saginaw (W. S.)	93	46	70.0	3.01	
Lawrence	95	68	82.4	5.92	Middleboro	87	46	69.3	4.77	St. Ignace	81	52	67.3		
Libertyhill	101	62	80.6	5.95	Monson	93	44	69.8	8.04	St. James	85	53	68.0	1.71	
Logansport				6.59	New Bedford	88	54	70.8	4.72	St. Joseph	92	52	70.3	2.07	
Mansfield	96	61	80.3	5.90	Plymouth	87	50	67.4	6.20	Slocum	87	42	67.4	3.03	
Melville	95	65	80.6	10.30	Provincetown	81	54	67.6	3.42	Somerset	92	46	68.2*	4.68	
Minden	100	61	81.2	5.27	Salem				4.88	South Haven	87	46	66.8	2.51	
Monron	96	62	81.2	12.20	Somerset*	92	50	74.8	3.39	Staunton	92	43	68.8	1.51	
Morgan City				8.52	Sterling				4.34	Thomaston	90	36	64.8		
New Iberia	92	71	81.0	11.27	Taunton	87	45	69.2	4.61	Thornville	91	46	70.1	3.73	
Opelousas	97	67	82.2	6.58	Westboro	90	43	71.4	3.88	Traverse City	90	42	68.0	1.30	
Oxford	98	62	80.8	8.15	Weston	87	42	69.0	4.59	Vassar	90	40	67.0	1.25	
Pearl River				9.15	Williamstown	84	48	68.6	5.50	Waspe	91	47	69.2	2.76	
Plain Dealing	100	60	80.7	8.01	Winchendon				4.45	Weberville	95	45	69.2	2.37	
Rayne	97	69	82.4	5.37	Worcester	89	50	71.6	6.14	Wetmore	90	36	63.4	1.25	
Reserve	102	68	82.8	4.95					Michigan.						
Robeline	95	61	80.0	12.96	Adrian	96	48	70.6	3.28	Albert Lea	92	48	70.1	3.23	
Ruston	97	60	80.4	7.10	Agricultural College	93	47	70.8	2.23	Alexandria	93	48	68.1	2.76	
Schriever	98	66	82.0	6.99	Albion	92	43	68.5	5.20	Amboy	94	49	69.5	2.32	
Simmesport				5.86	Alpena	95	48	70.6	5.23	Angus	88	46	65.6	3.09	
Southern University				5.03	Arbela	95	45	71.6	2.35	Ashby	88	47	67.4	4.19	
Sugar Experiment Station	95	71	82.2	6.18	Ball Mountain	90	49	68.4	4.60	Bagley	91	41	66.0	1.88	
Sugartown	95	65	80.8	5.83	Baraga	90	38	65.8	2.69	Beardsley	93	43	68.8	3.75	
<i>Maine.</i>					Battleground	93	47	70.4	4.08	Beaureieu	90	42	66.3	2.34	
Bar Harbor	85	43	65.0	2.28	Bay City	92	48	69.6	3.43	Bemidji	94	45	68.6	2.11	
Cornish	89	46	70.0	5.02	Berlin	93	43	68.6	3.78	Bird Island	90	50	68.8	4.99	
Danforth				2.21	Big Rapids	90	41	67.8	2.29	Caledonia	88	49	69.0	3.36	
Debsconeg	93	44	69.0	3.25	Birmingham	90	50	69.9	4.44	Campbell	91	42	66.6	3.40	
Fairfield	88	45	69.4	5.32	Blaney	87	38	65.3	1.82	Collegeville	91	51	70.0	3.44	
Farmington	88	41	67.5	6.38	Bloomingdale	95	47	70.0	2.71	Crookston	92	50	67.9	4.87	
Gardiner	85	46	67.7	6.40	Calumet	86	47	65.3	1.83	Detroit	92	42	66.2	3.48	
Greenville	94	84	67.7	6.28	Carsonville	92	46	68.7	2.24	Fairmont	91	50	69.4	1.52	
Houston	93	40	68.8	2.55	Cassopolis	90	50	70.8	4.50	Faribault	90	47	67.0	5.17	
Lewiston	88	50	71.0	5.44	Charlotte	90	45	69.6	1.81	Farmington	89	50	69.0	4.25	
Madison	87	42	67.0	4.58	Chatham	88	33	62.1	1.66	Fergus Falls	92	50	69.8	6.12	
Mayfield	86	44	67.0	4.66	Clinton	90	47	69.7	4.64	Fort Ripley	92			2.50	
Millinocket	94	40	69.6	3.24	Coldwater	94	46	70.5	3.82	Glenoe	92	51	70.2	3.49	
North Bridgton	88	46	70.0	5.82	Concord	92	45	69.8	3.56	Grand Meadow	92	47	68.4	2.69	
Oquosoc	92	37	69.8	4.57	Detour	89	49	66.7	1.85	Hallow	89	43	65.8	2.81	
Orono	87	42	68.6	2.47	Dundee	94	48	70.2	4.20	Halstead	91	43	66.8	3.14	
Patten	92	35	67.5	5.26	Eagle Harbor	88	38	59.7	0.97	Hinckley	92	46	67.7	1.12	
Rumford Falls	90	42	69.0	6.83	East Tawas	88	41	67.0	2.90	Hovland	84	38	63.2	0.95	
The Forks				4.56	Eloise	90	48	69.7	3.04	International Falls	96	39	67.8		
Vanburen	97	36	67.8	2.50	Fenville	90	46	69.0	1.14	Leech	91			2.32	
Winslow	88	40	68.7	5.18	Flint	94	44	69.3	2.25	Little Falls	92	49	69.8	1.50	
<i>Maryland.</i>					Grand Marais	81	44	68.8	1.46	Long Prairie	92	43	67.8	2.48	
Annapolis	92	60	76.6	6.29	Grape	91	48	69.9	5.93	Luverne	88	48	67.8	1.04	
Bachmans Valley	91	53	73.5	4.60	Grasslake	94	43	70.0	5.60	Mankato	91			3.92	
Cambridge	95	57	75.8	5.58	Grayling	90	36	66.2	3.25	Mapleplain	92	45	67.0	2.13	
Cheltenham	90	53	74.4	5.87	Hagar	98	43	70.4	2.15	Morris	91	27	68.6	4.03	
Chestertown	90	55	74.8	5.14	Harbor Beach	90	49	68.2	1.53	Mount Iron	90	42	65.2	3.32	
Chewsville	90	52	73.2	2.42	Harrison	91	42	69.4	0.70	New London	96	32	69.6	2.51	
Clearspring	89	55	72.2	6.44	Harrisville	86	48	66.6	3.39	New Ulm	93	49	70.6	4.77	
Coleman	92	58	75.0	6.45	Hart				1.79	Park Rapids	94	45	67.3	3.02	
Collegepark	93	54	74.8	6.81	Hastings	91	43	69.2	4.08	Pine River	91	45	68.4	1.79	
Cumberland				1.64	Hayes	90	45	67.4	1.40	Pipetown	86				

## MONTHLY WEATHER REVIEW.

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Mississippi.</i>						<i>Missouri—Cont'd.</i>						<i>Montana—Cont'd.</i>					
Aberdeen	98	59	79.2	6.08	Ins.	Koshkonong	91	59	74.2	4.19	Ins.	Philipsburg	94 <sup>1</sup>	40 <sup>1</sup>	64.4 <sup>1</sup>	0.82	Ins.
Agricultural College	97	64 <sup>1</sup>	79.6 <sup>1</sup>	3.20		Lamar	93	56	74.8	5.78		Plains	95	45	72.2	0.75	
Austin	96	59	78.1	8.93		Lamonte	90	56	72.6	6.25	2.05	Plentywood	109 <sup>b</sup>	35 <sup>b</sup>	68.5 <sup>b</sup>		
Batesville	96	59	78.4	6.47		Lebanon	95	56	75.1	1.30		Poplar	95	39	69.6	0.75	
Bay St. Louis	96	69	81.2	8.47		Lexington	92	56	74.6	2.41		Raymond	90	36	61.5	1.70	
Bellefontaine	95	56	78.3	3.71		Liberty	90	55	73.5	7.50		Redlodge	92	41	68.8	0.88	
Biloxi	96	69	82.6	4.21		Lockwood	90	55	73.5	7.50		Reno	92	41	68.8	0.88	
Hooneville	95	60	76.8	8.46		Louisiana	98	48	74.3	0.94		Ridgeway	95	38	67.7	0.75	
Brookhaven	97	63	80.9	4.15		Macon	100	56	76.1	1.31		St. Peter	87	41	66.0	0.53	
Canton	95	62	79.1	4.78		Marblehill	92	55	75.0	5.49		Saltese	95	36	68.0	0.30	
Columbia	96	62	79.2	7.27		Marshall	94	50	74.0	0.78		Springbrook	95	36	68.0	0.30	
Columbus	92	60	76.0	15.88		Maryville	92	55	71.7	7.87		Steele	91	43	69.5	0.65	
Corinth	92	60	76.0	15.88		Mexico	94	53	74.4	1.00		Tokna	99	40	70.4	0.21	
Crystal Springs	95	63	80.0	5.39		Monroe	99	53	74.3	2.98		Townsend	92	42	67.4	0.24	
Duck Hill	97	56	78.4	7.37		Mountain Grove	88	53	71.6	4.27		Toston	92	42	67.4	0.28	
Edwards	96	64	80.8	3.73		Montgomery	94	55	74.0	2.78		Troy	100	30	71.0	0.10	
Enterprise	91	63	78.2	7.82		Neosho	91	53	73.0	4.58		Twin Bridges	100	38	67.2	0.60	
Fayette (near)	91	63	78.2	6.96		New Haven	95	58	75.8	5.24		Utica	91	41	67.0	0.93	
Greenville	93	63	79.1	5.89		New Madrid	98	56	75.9	0.95		Virginia City	87	44	65.2	0.65	
Greenwood	95	61	78.6	4.90		New Palestine	98	56	75.9	0.95		Warrick	86	36	64.0	0.42	
Hattiesburg	99	62	81.7	4.40		Oakfield	95	58	75.1	4.77		Whitlash	88 <sup>b</sup>	34 <sup>b</sup>	65.8 <sup>b</sup>	0.30	
Hazlehurst	96	65	80.1	2.82		Olden	92	51	73.4	3.44		Wolf Creek	91	41	66.0	0.29	
Hernando	93	59	76.8	6.18		Oregon	92	55	72.8	1.33		Wolf Point	95	32	59.4	0.48	
Holly Springs	93	60	78.0	5.89		Osceola	97	55	75.8	1.95		Wolsey	86	32	59.4	0.95	
Jackson	97	62	80.0	4.64		Princeton	97	55	75.8	4.32		<i>Nebraska</i>					
Kosciusko	98	59	79.0	6.42		Rockport	95	55	75.1	4.03		Agate	93	38	64.2	2.09	
Lake	97	59	78.8	5.27		Rolla	97	56	75.8	1.49		Agree <sup>1</sup>	98 <sup>1</sup>	53	70.4 <sup>1</sup>		
Lake Como	100	60	80.5	6.67		St. Charles	95	57	75.8	2.49		Ainsworth	98	45	71.2	0.55	
Laurel	96 <sup>1</sup>	64 <sup>1</sup>	80.0 <sup>1</sup>	6.52		St. Joseph	95	50	74.0	1.80		Albion	89	45	67.8	2.31	
Leakesville	96	61	80.9	6.73		Sarcocie	96	50	74.0	6.88		Alliance	97	42	68.2	1.01	
Louisville	92	63	78.2	7.09		Sedalia	94	57	75.0	1.70		Alma	93	45	70.7	0.96	
McNeill	95	68	81.2	5.80		Seymour	89	52	70.8	5.30		Anoka	95	45	71.2	0.47	
Macon	96	63	79.7	8.30		Sikeston	92	57	75.8	4.90		Arapaho	95	45	72.2	0.87	
Magnolia	102	65	81.1	4.94		Steffenville	100	54	75.4	1.60		Aradria	90	54	71.8	4.98	
Merrill	98	55	78.0	6.52		Sublett	96	50	74.0	1.80		Ashland	90	54	71.8	4.68	
Merrill	97	65	80.9	5.92		Trenton	93	55	74.3	2.87		Ashton	90	50	71.2	5.97	
Natchez	97	62 <sup>1</sup>	80.2 <sup>1</sup>	9.37		Unionville	94	50	73.6	3.08		Atkinson	93	45	70.0	1.40	
Nitta Yuma	98	62 <sup>1</sup>	80.2 <sup>1</sup>	9.37		Versailles	94	55	74.4	2.12		Auburn	90	52	70.7	3.39	
Okolona	98	62	79.4	3.58		Warrensburg	97	56	76.4	2.97		Aurora	96	42	72.0	2.47	
Patmos	98	55	79.0	5.80		Warrenton	96	55	75.0	3.18		Beatrice	94	52	73.2	2.85	
Pearlington	94	67	79.9	8.40		Warsaw	95	52	74.6	3.89		Beaver	92	51	72.4	4.32	
Pittsboro	93	60	76.4	3.95		Willow Springs	92	50	70.2	4.11		Bellevue	90	55	72.1	5.86	
Pontotoc	88	61	76.0	4.26		Windsor	92	50	73.4	1.39		Benkelman	95	55	71.1	0.58	
Port Gibson	99	61	80.2	7.30		<i>Montana.</i>						Blair	90	50	71.2	3.36	
Porterville	97	62	79.2	4.88		Absarokee						Bloomfield	98	43	70.6	2.38	
Quitman	98	56	77.0	4.84		Adell	87	35	63.6	6.20		Bluehill	95	42	67.8	4.52	
Ripley	94	57	76.0	5.03		Anaconda	93	42	67.2	0.59		Bradshaw	95	42	67.8	3.22	
Shoocoe	98	61	80.6	5.03		Augusta	88	38	63.4	1.00		Bridgeport	95	42	67.8	1.22	
Shubuta	98	55	78.0	3.99		Babb	87	37	61.2	0.68		Broken Bow	93	43	68.0	5.89	
Stonington	98	64	80.2	6.40		Bear Creek	97 <sup>c</sup>	29	62.8 <sup>c</sup>	0.40		Burchard	95	42	67.8	3.98	
Suffolk	96	62	79.6	9.28		Billings	100	45	75.0	0.30		Burwell	95	42	67.8	1.95	
Tchula	96	62	79.6	9.28		Bozeman	89	41	65.4	0.47		Callaway	94	42	68.8	2.50	
Tupelo	94	60	78.0	5.79		Boulder	90	43	67.2	0.32		Central City	94	42	67.8	4.31	
University	94	61	77.6	4.09		Butte	92	45	67.0	0.20		Chester	95	42	67.8	1.33	
Utica	96	62	79.8	4.47		Canyon Ferry	92	46	69.0	0.05		Clearwater	93	43	69.2	1.21	
Walnut Grove	92 <sup>1</sup>	61 <sup>1</sup>	77.6 <sup>1</sup>	5.52		Cascade	98	48	71.4	0.80		Cody	95	42	67.8	0.63	
Water Valley	95	60 <sup>2</sup>	77.8 <sup>2</sup>	8.98		Chester	93	40	69.1	1.13		Columbus	92	50	69.8	3.02	
Waynesboro	94	60	80.0	5.62		Chinook	97	43	71.0	T		Crawford	90	54	72.5	0.95	
Woodville	98	65	81.3	8.15		Choteau	94	38	66.4	1.14		Crete	90	54	72.5	4.71	
Yazoo City	96	61	79.7	4.70		Clear Creek	91	37	66.6	0.21		Culbertson	100	46	73.8	2.38	
<i>Missouri.</i> </td																	

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Nebraska—Cont'd.</i>	○	○	○	In.	In.	<i>Nevada—Cont'd.</i>	○	○	○	In.	In.	<i>New Mexico—Cont'd.</i>	○	○	○	In.	In.
Imperial	99	44	68.8	2.67		San Jacinto	98	38	71.0	0.40		Hillsboro	.....	.....	.....	2.51	
Kearney	92	51	71.6	5.05		Soda Lake	102	50	79.0	.....		Hope	.....	.....	.....	1.67	
Kennedy	97	47	70.6	2.35		Squaw Valley	102	38	70.8	T.		Laguna	98	48	71.8	2.75	
Kimball	90	46	67.1	2.36		Tecoma	98	44	73.6	0.71		Lagunita	97	46	70.8	3.81	
Kirkwood	97	44	70.1	1.20		Wabuska	95	41	72.1	0.65		Lake Valley	.....	.....	.....	1.33	
Leavitt	96	50	72.7	2.06		Wadsworth	102	53	80.6	1.67		Las Vegas	63	42	65.2	7.82	
Lexington	92	43	68.8	2.04		Wells	99 <sup>a</sup>	42 <sup>a</sup>	71.7 <sup>a</sup>			Logan	99	51	73.3	4.98	
Lodgepole	90	40	65.3	1.30		<i>New Hampshire.</i>	.....	.....	.....	.....		Lordsburg	103	57	81.2	1.67	
Loup	91	48	69.8	6.29		Alstead	85	45	68.1	6.58		Los Alamos	.....	.....	.....	6.68	
Lynch	98	44	70.6	1.48		Bartlett	.....	.....	.....	.....		Los Lunas	97	52	78.2	0.65	
McCook	.....	.....	.....	2.65		Bethlehem	86	39	66.1	3.47		Luna	94	40	65.0	4.01	
McCool	.....	.....	.....	4.37		Bretton Woods	.....	.....	.....	.....		Magdalena	98	46	69.8	0.28	
Madison	89	50	70.0	2.70		Brookline	90	40	72.2	4.26		Manuelito	.....	.....	.....	1.95	
Marquette	.....	.....	.....	4.71		Durham	90	43	68.9	3.56		Mesilla Park	103	55	78.4	2.21	
Mason	.....	.....	.....	4.60		Franklin Falls	91	44	69.8	4.08		Mimbres	.....	.....	.....	2.64	
Merriman	.....	.....	.....	0.68		Grafton	88	35	66.6	5.44		Mineral Hill	.....	.....	.....	5.98	
Minden	95	49	71.2	3.35		Groveton	.....	.....	.....	.....		Monument	101	56	75.0	4.11	
Monroe	.....	.....	.....	1.85		Hanover	89	42	69.9	3.67		Nara Visa	94	54	72.8	8.29	
Nebraska City	90	53	71.1	4.12		Keene	89	41	69.6	4.88		Orange	100	55	76.4	2.69	
Nemaha	.....	.....	.....	3.72		Littleton	86	40	67.5	3.08		Orogrande	100	56	76.6	1.81	
Norfolk	91	46	70.6	2.22		Nashua	92	44	71.8	3.98		Palma	.....	.....	.....	8.20	
North Loup	93	41	70.1	4.61		Newton	87	41	68.2	5.48		Portales	95	55	73.6	5.20	
Oakdale	92	47	70.3	1.49		Plymouth	92	40	69.8	3.64		Red River	79	35	55.8	4.39	
Oakland	88	48	69.3	2.62		<i>New Jersey.</i>	.....	.....	.....	.....		Redrock	.....	.....	.....	3.07	
Odell	.....	.....	.....	4.67		Asbury Park	94	61	71.4	5.08		Rincon	101	54	79.0	0.44	
Ord	.....	.....	.....	2.62		Bayonne	89	54	73.8	4.70		Rociada	81	39	56.4	7.66	
Palmer	.....	.....	.....	3.95		Belvidere	88	52	75.6	3.97		Rosa	.....	.....	.....	3.33	
Palmyra	92	58	71.9	5.70		Bergen Point	88	56	73.8	4.28		Rosedale	91	46	66.5	2.59	
Pawnee City	94	51	71.7	3.51		Beverly	91	55	75.0	6.92		San Marcial	110	50	79.2	.....	
Plattsmouth	.....	.....	.....	3.75		Bridge顿	94	55	75.4	5.72		San Rafael	99	50	72.4	1.98	
Plymouth	93	50	72.6	3.74		Browns Mills	92	52	72.8	6.23		Socorro	106	42	76.0	1.32	
Purdum	97	44	70.0	1.02		Canton	.....	.....	.....	.....		Springer	93	31	67.0	3.54	
Ravenna	90	47	69.8	4.00		Cape May C. H.	88	57	73.0	4.24		Strauss	.....	.....	.....	0.86	
Redcloud	92	.....	.....	4.42		Charlotteburg	89	46	69.7	7.51		Taos	92	44	65.0	3.05	
Republican	.....	.....	.....	0.40		Clayton	89	54	73.6	5.18		Tres Piedras	87	39	60.0	5.88	
Rulo	.....	.....	.....	1.88		College Farm	91	52	73.3	6.10		Tucumcari	98	56	75.0	4.21	
St. Libery	.....	.....	.....	2.96		Dover	86	48	70.4	7.58		Valley	.....	.....	.....	1.90	
St. Paul	90	51	70.5	8.68		Elizabeth	94	59	76.0	3.57		Vermejo	89	40	65.4	6.02	
Santee	93	51	72.0	2.39		Englewood	89	54	73.2	3.44		Weed	.....	.....	.....	3.11	
Schnuyler	.....	.....	.....	3.20		Flemington	91	53	73.9	6.28		Whiteoaks	.....	.....	.....	2.11	
Seward	90	50	72.4	4.07		Friesburg	91	54	74.6	4.93		Winsor	.....	.....	.....	4.01	
Smithfield	.....	.....	.....	5.83		Hightstown	89	50	72.2	3.38		<i>New York.</i>	.....	.....	.....	.....	
Springview	100	47	71.4	0.87		Imaystown	89	54	73.6	7.74		Adams	90	49	72.6	4.76	
Stanton	91	48	70.8	1.95		Indian Mills	93	53	74.4	4.69		Addison	93	46	70.2	3.22	
Strang	.....	.....	.....	5.41		Jersey City	90	56	75.3	4.41		Akron	.....	.....	.....	2.31	
Stratton	.....	.....	.....	1.73		Lakewood	87	55	71.8	6.28		Amsterdam	90	48	69.9	6.50	
Strausburg	.....	.....	.....	6.06		Lambertville	90	52	74.8	6.10		Angelica	88	39	67.2	4.69	
Superior	.....	.....	.....	1.66		Layton	88	46	70.3	5.64		Appleton	93	48	69.9	3.08	
Syracuse	95	54	70.4	3.75		Moorestown	90	53	73.5	4.11		Athens	88	52	71.5	3.81	
Tablerock	.....	.....	.....	3.35		Newark	90	53	74.3	3.71		Atlanta	88	40	67.4	2.66	
Tecumseh	94	50	72.0	1.56		New Brunswick	91	53	73.5	6.05		Atwater	.....	.....	.....	2.54	
Tekamah	91	51	71.2	4.35		Newton	90	47	72.2	5.73		Auburn	88	50	70.2	6.07	
Turlington	91	54	71.7	3.46		Oceanic	87	59	72.2	5.46		Avon	88	47	69.4	4.80	
University Farm	20	51	71.9	7.88		Paterson	91	55	74.6	5.74		Baldwinville	89	51	70.4	2.62	
Wahoo	.....	.....	.....	8.17		Phillipsburg	91	53	74.1	4.00		Ballston Lake	88	50	69.6	4.08	
Wakefield	92	45	69.4	1.12		Plainfield	89	54	73.4	5.99		Bedford	89	51	72.9	5.39	
Watertown	.....	.....	.....	4.41		Pleasantville	.....	.....	.....	.....		Berlin	89	45	69.2	5.32	
Wauneta	.....	.....	.....	1.24		Rancocas	.....	.....	.....	.....		Blue Mountain Lake	.....	.....	.....	4.06	
Weeping Water	.....	.....	.....	2.73		Rivervale	89	50	72.2	6.86		Bolivar	89	36	67.0	2.00	
Westpoint	90	48	72.0	3.87		Sandy Hook	88	60	73.2	8.28		Bouckville	85	42	68.4	3.06	
Wilber	.....	.....	.....	2.75		Somerville	90	52	74.0	5.98		Brockport	90	49	71.4	3.09	
Wilsonville	.....	.....	.....	2.20		South Orange	89	56	72.6	4.62		Cape Vincent	87	48	69.2	2.00	
Winnebago	91 <sup>a</sup>	44 <sup>a</sup>	67.8 <sup>a</sup>	.....		Sussex	86	50	71.4	6.11		Carmel	85	59	71.2	6.92	
Wisner	.....	.....	.....	2.28		Trenton	90	54	74.								

TABLE II.—*Climatological record of cooperative observers—Continued.*

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>New York—Cont'd.</i>	°	°	°	Ins.	Ins.	<i>North Carolina—Cont'd.</i>	°	°	°	Ins.	Ins.	<i>Ohio—Cont'd.</i>	°	°	°	Ins.	Ins.
La Roy	87	47	69.2	2.46		Southern Pines	95	59	77.5	9.12		Jacksonburg	94	34	75.0	7.66	
Liberty	86	43	67.6	3.19		Southport	91	66	79.4	12.88		Killbuck	89	49	71.4	5.22	
Littlefalls, City Res.	88	52	70.2	5.28		Statesville	91	58	74.7	8.68		Lancaster	87	51	71.5	5.06	
Lockport	88	48	70.3	2.29		Tarboro	98	61	79.0	6.53		Lima	97	50	72.0	3.14	
Lowville	88	44	67.0	2.47		Vade Mecum	92	54	74.4	9.88		McConnelsville	89	50	72.4	5.50	
Lyndonville						Washington	98	65	79.2	14.54		Manara	88	54	72.0	5.18	
Lyons	93	50	71.8	3.56		Waynesville	85	51	69.0	7.38		Marietta	89	55	74.4	3.55	
Middletown	87	53	72.2	7.81		Weldon	100	58	79.0	6.09		Marion	93	46	72.6	6.07	
Mohonk Lake	81	53	68.2	5.78		<i>North Dakota.</i>						Medina	89	43	71.4	4.37	
Moira	91	42	69.6	1.85		Amenia	93	46	66.7	2.07		Mifordton	90	46	70.0	5.05	
Mount Hope	91	44	72.2	3.76		Berlin	93	40	65.7	5.92		Milligan	91	46	71.0	3.81	
Newark Valley				1.87		Bottineau	98	37	66.8	1.88		Millport	87	46	68.9	3.84	
New Lisbon	86	45	65.4	5.20		Buford	93	39	67.8	0.43		Nelle	89	55	71.0	5.98	
North Lake	86	46	66.2	5.53		Cando	91	38	64.9	0.77		New Alexandria	91	51	72.3	5.37	
Ogdensburg	92	47	72.0	2.15		Coalharbor	96	46	67.6	1.32		New Berlin	90	48	70.8	5.48	
Oneonta	90	52	69.8	4.18		Cooperstown	97	45	65.3			New Bremen	91	48	72.4	3.76	
Oriskany Falls	89	47	69.8	2.00		Dickinson	96	38	66.9	0.16		New Richmond	92	55	74.1	8.11	
Oxford	85	51	68.6	3.31		Donnybrook	93	41	65.4	1.03		New Waterford	89	46	69.8	4.17	
Oyster Bay	91	57	72.7	5.50		Dunseith	94	40	65.2	1.19		North Lewisburg	95	48	73.4	6.30	
Palermo				2.15		Edgeley	99	44	67.2	3.17		North Royalton	90	50	71.2	4.99	
Perry City	89	41	67.6	4.98		Ellendale	99	48	71.4	1.70		Norwalk	98	47	72.6	4.75	
Plattsburgh	87	46	70.4	5.46		Fargo	92	48	67.8	2.68		Oberlin	92	47	71.2	3.69	
Port Jervis	89	51	74.0	5.36		Flasher	102	39	69.2	0.86		Ohio State University	89	50	71.4	5.98	
Potsdam	92	42	69.6	2.05		Forman	95	47	69.3	4.18		Orangeville	93	46	71.2	2.56	
Richland				2.06		Fort Berthold	97	40	67.4	1.19		Ottawa	94	50	73.8	3.36	
Ridgeway	87	49	70.8	3.05		Fort Yates	101 <sup>a</sup>	45 <sup>a</sup>	70.4 <sup>a</sup>	1.25		Pataskala	89	49	71.2	5.51	
Romulus	88	51	70.6	1.37		Fullerton	91	43	66.8	5.39		Philo	90	52	73.0	3.49	
Saranac	86	36	64.4	3.45		Glenullin	98	42	68.2	1.25		Plattsburg	91	50	71.7	4.48	
Scarsdale	87	52	71.7	2.45		Grafton	95	40	66.0	2.47		Pomeroy	92	52	73.7	4.91	
Scottsville				2.78		Hamilton	91	47	66.6	3.53		Portsmouth	91	53	74.4	5.81	
Setauket	86	57	71.3	8.62		Hannan	90	39	63.8	1.35		Pulse	87	51	72.2	8.88	
Shortsville	85	49	69.1	4.08		Hillsboro	95	49	69.2	2.71		Rittman	92	45	71.8	6.89	
Skeaneateles				3.95		Jamestown						Rockyridge	93	50	72.9	2.08	
Southampton	87	56	69.9	4.60		Kulm	95	46	67.6	2.17		Shenandoah	89	47	69.6	9.60	
South Canisteo	87	40	66.4	3.66		La Folette	93 <sup>a</sup>	41 <sup>a</sup>	66.7 <sup>a</sup>	1.16		Sidney	92	50	73.6	4.30	
South Schroon	85	41	65.6	5.90		La Moure						Somerset	92	52	73.4	6.41	
Spier Falls	88	46	69.4	3.44		Langdon	91	47	65.2	3.07		South Lorain	92	44	70.9	3.92	
Taberg				3.58		Larimore	91	45 <sup>a</sup>	66.1 <sup>a</sup>	1.51		Springfield				10.25	
Ticonderoga	96 <sup>b</sup>	48 <sup>b</sup>	61.1 <sup>b</sup>	1.97		Lisbon	96	41	65.5	4.91		Summerfield	89	47	71.0	5.11	
Volusia	88	45	68.2	2.69		McKinney	95	34	66.2	0.50		Thurman	91	53	73.8	7.04	
Wappinger Falls	88	52	71.6	7.70		Manfred	95	44	67.4	1.18		Tiffin	91	52	72.6	5.65	
Warwick				5.85		Melville	102 <sup>a</sup>	46 <sup>a</sup>	67.8 <sup>a</sup>	2.17		Toledo (St. Johns College)	95	53	72.1	4.91	
Watertown	88	48	69.8	4.41		Medora	96	35	67.6	0.72		Upper Sandusky	90	48	72.3	3.81	
Waverly	90	44	70.2	2.85		Minot	98	40	67.2	1.20		Urbana	94	46	71.6	5.49	
Wedgewood	87	49	68.4	2.79		Minto	92	45	66.3	3.32		Vickery	93	47	71.8	5.70	
West Berne	87	45	68.6	3.23		Moyersville	96	41	65.3	1.39		Warren	91	45	71.1	5.96	
Westfield	85	49	69.2	2.68		Napoleon	101	40	66.2	1.19		Wauseon	95	47	71.2	4.38	
Youngstown				2.27		New England.						Waverly	93	51	74.1	5.93	
<i>North Carolina.</i>						Oakdale	93	43	68.4	0.60		Waynesville	90	52	72.5	2.63	
Battleboro						Amesville	91	45	66.2	1.93		Wellington	90	47	71.6	3.91	
Beaufort	89	68	79.3	7.21		Atwater	86	48	69.3	5.34		Willsbough				1.56	
Brevard	88	53	71.0	13.89		Bangorville	90	52	71.9	5.32		Wilson	91	49	72.8	5.09	
Brewers	93	57	74.2	9.99		Bellefontaine	90	50	70.1	5.50		Wooster	88	46	71.0	4.93	
Bryson City				9.48		Benton Ridge	94	50	73.0	5.18		Zanesville				4.78	
Buck Springs	81	50	63.3	9.57		Bladensburg	91	44	69.9	3.56		<i>Oklahoma.</i>					
Caroleen	96 <sup>b</sup>	62 <sup>b</sup>	76.8 <sup>b</sup>	7.43		Bowling Green	94	49	71.8	6.13		Alva	99	57	75.6	6.23	
Chalybeate Springs	95	60	78.5	8.21		Bucyrus	91	46	70.8	5.80		Arapaho	96	55	73.4	8.38	
Eagletown	93	65	76.6	7.98		Cadiz	90	51	72.2	5.10		Cache	98	52	75.5	0.92	
Edenton	90	60	76.5	16.18		Cambridge	88	48	71.0	3.76		Chandler	102	55	78.9	4.92	
Fayetteville	93	63	76.8	9.19		Camp Dennison	93	51	74.2	7.10		Chattanooga	99	62	78.8	4.20	
Goldsboro	93	61	76.8	12.67		Canal Dover	90	48	71.2	4.17		Cloud Chief				7.00	
Graham				6.31		Canton	86	49	70.8	6.65		Dacoma	102	56	75.7		

TABLE II.—*Climatological record of cooperative observers—Continued.*

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Oregon—Cont'd.	o	o	o	Ins.	Ins.	Pennsylvania—Cont'd.	o	o	o	Ins.	Ins.	South Carolina—Cont'd.	o	o	o	Ins.	Ins.
Bay City	94	44	61.0	0.26		Girardville	88	46	70.0	5.20		St. Stephens	o	o	o	7.51	
Bend	99	37	69.8	0.55		Gordon	88	46	70.0	4.30		Saluda	96	61	78.2	6.22	
Blackbutte	98	48	70.3	0.00		Greensburg	90	44	70.7	2.22		Santuck	99	63	77.7	5.31	
Bialock	110	59	85.1	T.		Hamburg	93	53	74.0	3.66		Seivern	95	60	78.0	8.62	
Bullrun	105	48	70.8	0.05		Hanover	94	54	75.7	2.90		Smiths Mills	92	67	78.9	12.10	
Burns	97	42	72.8	0.36		Herrs Island Dam	91	50	71.2	2.12		Societyhill	92	67	78.9	6.79	
Carlton	102	42	69.4	0.00		Huntingdon	91	50	71.2	1.41		Spartanburg	98	63	77.3	7.97	
Cascade Locks	102	50	73.8	0.00		Hyndman	90	48	71.1	4.09		Stateburg	93	65	78.2	9.90	
Coquille			T.			Indiana	92	49	72.1	4.54		Summerville	95	64	79.4	13.27	
Corvallis	100	46	70.3	T.		Irwin	92	49	72.1	4.16		Sumter	96	65	80.2	8.93	
Dale			0.25			Johnstown	93	51	72.2	8.98		Trenton	94	56	77.2	14.76	
Dayville	103	44	75.2	0.08		Kennett	89	54	72.6	6.06		Trial	94	56	78.2	8.96	
Doraville	95	48	66.8	T.		Lansdale	90	45	69.2	3.00		Walhalla	98	60	76.6	13.87	
Drain	104	41	60.7	0.00		Lawrenceville	89	45	69.2	4.06		Walterboro	92	66	77.8	11.65	
Echo	107	54	81.9	0.15		Lebanon	90	52	73.4	4.87		Winnboro	95	65	78.4	5.54	
Ella	109	54	83.2	0.02		Leroy	89	49	68.4	6.34		Winthrop College	96	64	78.0	7.83	
Falls City	99	42	68.6	0.03		Lewisburg	90	50	72.6	3.63		Yemassee	93	65	78.8	9.90	
Forrest Grove	103	42	68.8	T.		Lockhaven	92	50	72.8	5.30		Yorkville	100	66	79.2	6.24	
Gardiner	84	50	62.7	0.11		Lock No. 4						South Dakota					
Glendale	103	43	71.5	0.00		Lycippus	86	54	71.8	3.74		Aberdeen	99	48	69.8	1.11	
Glenora	103	45	67.6	T.		Marion	90	54	72.7	2.24		Academy	97	48	71.7	1.37	
Gold Beach	75	41	58.3	0.00		Mifflintown	91	49	71.8	3.56		Alexandria	92	46	70.8	2.20	
Governor Camp	91	41	63.4	T.		Milford	89	47	70.4	5.74		Armour	100	42	71.9	0.97	
Granite	95	31	65.3	0.52		Montrose	87	51	67.4	2.66		Ashcroft	98	38	68.6	0.54	
Grants Pass	108	44	75.0	0.00		New Germanstown	90	50	71.3	2.32		Bellefourche	101 <sup>a</sup>	43 <sup>a</sup>	71.2 <sup>a</sup>	0.69	
Grass Valley	100	40	70.6	T.		Ottsville						Bowdle	100	43	68.8	1.35	
Heisler	102	47	68.4	1.15		Parker	89	58	75.3	4.82		Brookings	90	42	66.5	1.86	
Heppner	105	49	76.2	T.		Philadelphia	89	58	75.3	2.94		Canton	90	44	68.8	1.35	
Hood River	106	55	75.9	0.00		Pocono Lake	87	42	65.6	7.18		Castlewood	87	42	65.7	1.40	
Huntington	104	57	82.7	0.15		Point Pleasant						Centerville	91	45	68.6	1.32	
Jacksonville	104	48	77.6	0.00		Pottsville						Chamberlain	100	47	72.7	0.46	
Joseph	94	45	69.8	1.34		Radford						Cherry Creek	107	41	72.4	0.46	
Kerby	102	45	72.2	0.00		Reading	94	55	74.4	5.32		Clark	88	44	67.9	2.73	
Klamath Falls	101	45	75.4	0.06		Renovo	89	39	69.0	1.87		Clear Lake	88	49	67.9	1.95	
La Grande	101	45	73.8	T.		Saegerstown	86	42	67.4	4.96		Desmet	89	45	67.5	1.59	
Lakeview	102	43	73.5	0.20		St. Marys	90	50	72.4	3.28		Doland	91	48	69.4	2.35	
Lonerock	98	46	71.6	T.		Saltsburg						Elkpoint	92	46	72.4	0.75	
Lost River	97	39	69.5	0.19		Seisholtzville						Fairfax	95	43	72.2	1.14	
McKenzie Bridge	107	40	70.6	0.00		Selinsgrove	89	52	73.8	4.67		Farmingdale					1.50
McMinnville			T.			Shawmont						Faulkton	101	46	69.5	1.39	
Marfield	81	50	69.9	0.06		Skidmore	89 <sup>a</sup>	42 <sup>a</sup>	71.0 <sup>a</sup>	7.31		Flandreau	88	44	66.5	1.10	
Mill City	102	40	68.0	0.00		Smiths Corners						Forestburg	92	40	67.6	2.21	
Monroe	95	41	69.2	0.00		Somerset	87	42	66.2	4.54		Fort Meade	99	46	70.6	1.45	
Mountain Park	97	52	74.2	0.01		South Eaton	86	53	70.4	4.60		Gann Valley	97	45	70.9	0.85	
Mount Angel	101	50	73.2	0.06		Springdale						Greenwood	95	49	72.2	2.05	
Nehalem			0.07			Springmount						Hermosa	100	44	69.9	1.37	
Newport	84	43	58.2	0.00		State College	87	51	69.9	5.18		Highmore	101	45	70.8	1.19	
Odell			2.07			Towanda	86	49	69.6	3.51		Hitchcock					1.78
Olex	104	51	77.8	0.05		Uniontown	89	50	72.8	2.00		Howard	90	42	67.6	1.69	
Ontario			0.20			Warren	90	43	70.4	3.41		Howell	101	43	70.0	1.35	
Paisley	92	50	71.4	1.03		Wellsboro	86	46	66.9	2.19		Ipswich	101	45	69.6	0.66	
Pendleton	107	42	77.4	T.		Westchester	91	55	73.1	7.15		Kennebec	103	40	71.4	0.18	
Port Oxford	73	50	59.9	0.00		West Newton						Kidder	91	44	65.2	5.71	
Prineville	98	42	70.6	0.81		Whitehaven	86	49	69.4	3.26		Kimball	96	46	71.2	1.26	
Prospect			0.00			Wilkesbarre	89	50	72.8	3.87		Leola	96	40	68.2	0.72	
Richland	100	43	74.7	0.15		Williamsport	87	52	71.7	3.26		Little Eagle	103	40	70.1	0.75	
Salem	100	51	72.0	T.		Rhode Island						Marion	91	45	70.0	2.84	
Silverlake	97	31	67.2	0.64		Bristol	82	54	68.6	3.20		Mellette	97	41	69.3	1.52	
Sisters	103	34 <sup>b</sup>	67.1 <sup>b</sup>	0.29		Kingston	86	50	68.4	4.05		Menno	90	45	68.8	1.77	
Sparta	102	40	75.4	0.13		Pawtucket	90	52	71.5	6.69		Milbank	94	46	68.6	2.93	
Stafford	100	50	71.4	0.70		Providence	92	53	74.3	5.47		Mitchell	96	47	71.2	1.29	
The Dalles	104	55	78.6	T.		<i>South Carolina</i>	98	67	82.3	10.09		Oelrichs	100	42	69.4	1.10	
Toledo	98	47	64.5	T.		Aiken	96	61	77.1	6.25		Pine Ridge					1.13
Umatilla	115	59 <sup>a</sup>	86.														

TABLE II.—*Climatological record of cooperative observers—Continued.*

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<b>Tennessee—Cont'd.</b>						<b>Texas—Cont'd.</b>						<b>Utah—Cont'd.</b>					
Florence	92	58	75.0	5.96		Hempstead	92	58	75.0	7.55		Moab	102	50	76.4	0.77	
Franklin	91	57	74.8	4.33		Henrietta	101	58	78.8	2.48		Morgan	90	40	66.4	0.11	
Greeneville	90	57	73.2	5.52		Hewitt	101	62	81.2	2.04		Mount Nebo	96	54	76.9	0.77	
Halls Hill				9.83		Hondo	97	69	82.0	5.86		Mount Pleasant	95	51	72.7	0.90	
Harrison	92	60	74.2	10.64		Houston	100	69	83.8	5.60		Nephi					1.45
Hohenwald	97	48	72.6	10.05		Hubbard	97	65	80.5	4.24		Oak City	95	51	74.8	0.83	
Iron City	96	55	75.2	7.63		Huntville	98	64	81.5	6.05		Ogden	96	57	75.4	0.44	
Jackson	99	57	77.6	10.59		Jefferson	94	60	79.2	8.66		Parowan	93	47	71.6	1.71	
Johnsonville	100	55	76.7	4.70		Jewett	95	63	80.2	3.14		Payson	90	40	67.9	1.01	
Jonesboro	93	55	74.1	7.35		Junction						Pinto	89	40	64.8	1.15	
Kenton	98	57	77.1	4.73		Kaufman	100	63	82.4	7.32		Plateau	105	51	76.8	0.10	
Kingston				8.75		Kent	104	48	75.5	6.54		Ranch	90	40	64.2	2.94	
Lafayette	99	53	75.2	5.15		Kerrville	99	63	83.6	3.01		Randolph					0.40
Leadville				4.17		Knickerbocker	101	61	79.2	3.79		Richfield	94	37	68.6	0.85	
Lewisburg	98	57	76.6	9.30		Kopper						Rockville	107	60	85.0	0.83	
London				8.75		Lampasas	100	62	80.4	4.47		St. George	110	56	85.3	0.71	
Lynnville	92	59	75.4	7.28		Lapara						San Juan					2.29
McGee				11.35		Liberty	100	66	83.1	5.60		Scipio	95	43	69.0	0.46	
McMinnville	93	57	74.1	9.68		Llano	102					Snowville	98	40	69.4	0.54	
Maryville	94	59	74.8	11.54		Longlake						Soldier Summit	98	30	64.6	0.19	
Milan	97	55	76.7	5.30		Longview	101	62	82.1	5.88		Sunanside					2.59
Monterey	89	56	72.0			Luling	100	69	83.9	3.86		Theodore	92	44	69.4	0.56	
Newport	91	61	75.0	6.51		Marlin	100	64	81.6	3.44		Thistle	105	40	71.8	0.10	
Palmetto	97	57	76.4	7.59		Menardville						Tooele	97	55	74.8	0.61	
Pope				7.13		Mexia	97	60	80.8	1.48		Tropic	96	46	72.0	0.28	
Rogersville	95	55	74.8	7.54		Miami	97	49	77.4	5.42		Trout Creek	94	46	71.4	1.60	
Rugby	90	51	71.9	16.82		Mobeetee	95	50	73.1	5.41		Utah Lake	94	46	71.5	1.18	
Savannah	96	58	75.8	12.12		Mount Blanco	97	48	75.7	2.27		Vernal	94	48	71.5		
Severville	94	72	75.2	7.99		Mount Pleasant	99	59	80.0	4.70		Wellington	95	42	70.1	0.35	
Sewanee	89	58	71.8	9.71		Nacogdoches	94	62	79.4	7.91		<b>Vermont.</b>					
Silver Lake	85	61	69.4	7.28		Nazareth	96	48	73.0	4.23		Cavendish	89	40	67.2	2.79	
Sparta	90	58	74.4	10.36		New Braunfels	97	69	81.8	3.25		Chelsea	86	41	65.8	3.12	
Springdale	94	54	74.6	6.97		Panter						Enosburg Falls	88	39	68.2	4.08	
Springville	100	50	76.6	8.10		Paris	99	60	81.0	5.28		Jacksonville	87	40	66.6	2.24	
Tazewell				7.96		Port Lavaca	99	73	84.7	1.58		Manchester	83	44	67.0	3.88	
Tellico Plains	92	58	74.8	12.49		Quanah	98	60	79.5	4.32		Norwich	89	40	67.6	4.21	
Tracy City	93	54	71.0	9.64		Rhineland	102	50	78.6	5.50		St. Johnsbury	91	40	69.4	3.68	
Trenton	98	50	76.8	1.71		Riverside						Wells	90	45	68.5	3.37	
Tullahoma	95	55	74.4	5.45		Rock Island	98	63	82.8	3.53		Westfield					3.69
Union City	94	55	75.8	2.98		Rockland						Woodstock	84	41	65.1	2.78	
Walling				7.85		Rockport	92	72	83.0	1.30		<b>Virginia.</b>					
Watertown	100	57	76.8	7.40		Sabin	100	59	82.1	5.92		Arvonia	95	48	76.2	3.35	
Waynesboro	95	55	74.9	9.63		San Marcos	99	68	83.0	2.30		Barboursville	90	55	75.0	5.31	
Wildersville	91	56	74.6	3.64		San Saba	99	62	79.6	5.53		Bigstone Gap	88	54	72.2	7.22	
Yukon	95	61	75.8	6.61		Santa Gertrude						Blacksburg	92	45	68.3	5.86	
<b>Texas.</b>						Seymour	97	57	77.5	8.20		Buchanan					5.16
Albany	99	55	78.4	8.53		Sherman	97	60	79.6	10.50		Burkes Garden	82	43	66.0	6.18	
Alvin				12.50		Sonora	99	60	78.0	4.52		Callaville	94	54	76.0	10.69	
Arthur				4.75		Sulphur Springs	98	64	80.0	6.30		Charlottesville	95	53	75.4		
Arhens	100	68	82.8	4.50		Temple	96	63	79.4	4.08		Columbia	92	52	75.1	4.67	
Austin	99	71	84.2	1.88		Texline	97	45	71.3	4.90		Dale Enterprise	95	51	72.4	3.28	
Ballinger	101	59	80.4	7.19		Tilden	106	68	86.0	1.47		Danville					7.23
Barstow	101	60	78.1	4.23		Trinity	99	64	82.1	8.36		Dinwiddie	95	58	75.0	6.06	
Beaumont				6.56		Uvalde						Doswell	98	51	76.0	9.09	
Beeville	102	70	84.8	3.08		Valley Junction						Elk Knob	87	58	71.8	6.58	
Big Spring	108	59	80.1	4.41		Victoria	97	67	82.9	4.93		Farmville	95	50	76.1		
Blanco	97	65	80.8	3.65		Waco	100	68	83.4	5.88		Fredericksburg	92	55	75.4	4.89	
Boerne	101	62	79.4	7.00		Waxahachie	100	61	81.0	2.46		Graham's Forge	87	51	70.2	6.32	
Bonham				7.50		Weatherford	101	65	81.1	4.51		Hampton	96	65	77.2	8.23	
Booth				8.91		Wharton	98	70	73.8	4.81		Hot Springs	86	50	68.2	8.13	
Brazoria	94	69	81.8	7.71		Wills Point	98	68	79.8	5.95		Ivanhoe					5.35
Brenham	93	69	81.4	8.92		Utah.						Lexington	92	54	71.8	3.98	
Brighton	93	70	83.7	0.47		Alpine						Lincoln	94	49	75.2	2.66	
Brownwood	105	61	80.6	4.31		Aneth						Marion	92	53	71.1	6.26	
Channing	101	54	75.4	3.62		Castledale	93	40	66.6	0							

TABLE II.—Climatological record of cooperative observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	Ins.	Ins.	West Virginia—Cont'd.	°	°	°	Ins.	Ins.	Wyoming—Cont'd.	°	°	°	Ins.	Ins.
Colfax	98	42	70.6	0.62		Parsons	86	50	69.4	3.32		Gillette	98	46	69.2	0.30	
Colville	102	42	71.8	0.74		Philipi	90	50	71.8	4.21		Granite Canyon	83	33	58.6	1.79	
Conconully	96	46	72.4	0.36		Pickens	85	49	68.4	4.52		Granite Springs				1.94	
Coupeville	88	47	63.2	0.26		Point Pleasant	91	55	73.6	5.12		Green River	93	39	67.2	0.62	
Crescent	99	46	72.8	0.42		Powellton	92	53	73.7	4.44		Griggs	92	39	65.2	2.29	
Danville	102	46	75.4	0.15		Princeton						Hatton				2.09	
Dayton	99	52	76.2	0.02		Romney	96	53	75.4	4.10		Hyattville	97	40	69.2		
East Sound	89	42	63.8	0.30		Rowlesburg						Jackson	86	26	59.5	0.69	
Ellensburg	103	45	75.2	0.09		Ryan	90	49	72.4	3.66		Kirtley	91	39	64.0	0.88	
Ephrata	109	59	83.0	0.20		Smithfield						Laramie	82	37	60.3	1.75	
Fort Simcoe	104	54	80.8	T.		Southside	92	52	75.7	5.27		Leo	86	35	60.0	0.57	
Goldendale	106	52	73.1	0.10		Spencer	94	49	72.0	6.63		Little Medicine	84	36	57.3	1.01	
Grandmound	102°	49°	68.4°	0.10		Sutton	98	54	75.4	5.05		Lolabama Ranch	84	29	56.6	0.67	
Granite Falls						Terra Alta	88	50	68.4	7.00		Lusk	90	35	62.5	0.61	
Hatton	109	45	79.4	0.06		Union	93	52	70.0	4.52		Moorecroft	98	40	70.0	0.78	
Ilwaco	98	51	60.7	0.38		Upperpart	91	50	71.2	4.17		Moore	90	34	62.4	0.99	
Kennewick	111°	56°	86.4°	T.		Valley Fork	93	53	72.6			Newcastle	97	38	70.0	0.68	
Kiona	106	52	80.6	0.00		Wellsburg	85	52	70.8	5.45		Pathfinder	99	41	69.6	0.84	
Kosmos	104	45	70.0	0.04		Weston	92	52	72.6	3.76		Phillips	90	41	63.6	1.94	
Lacenter	99	47	69.3	T.		Wheeling						Pine Bluff	93	38	65.8	2.04	
Lakeside	104	57	80.4	0.11		Williamson	92	58	74.8	4.43		Pinedale	87	30	59.2	1.43	
Lester	99	41	68.5	0.60		Wisconsin.						Saratoga	89	34	62.8	1.04	
Lind	108	50	78.4	0.02		Amherst	90	44	70.8	2.40		Sheridan	93	36	64.9	0.70	
Loomis	102	58	80.1	T.		Appleton Marsh	89	44	67.2	2.83		Shoshone Canyon	92	45	69.0	0.72	
Merritt						Ashland	90	43	67.7	2.38		South Pass City	95	30	57.6	1.61	
Mettinger Ranch	112	57	85.0	0.00		Beloit	91	48	70.4	2.33		Wells	82	30	54.8	1.19	
Mount Pleasant	100	48	70.1	0.20		Brodhead	94	43	71.2			Wheatland	98	43	70.6	1.41	
Moxee	105	51	78.9	0.08		Burnett	89	44	67.9	2.45		Willow Creek Cabin	85	31	57.9	1.76	
Northport	99	40°	71.6°	0.02		Butternut	91	39	68.5	0.79		Wolf	92	45	69.4	0.90	
Odessa	111	50	81.4	0.00		Chilton	90	45	68.6	2.68		Yellowstone Pk. (F'tain)	83	30	55.8	0.30	
Olga	79	50	61.2	0.23		Chippewa Falls						Yellowstone Pk. (G'd Cn.)	79	30	55.2	1.07	
Olympia	104	42	69.0	0.30		City Point	92	58	74.2	2.96		Yellowstone Pk. (Lake)	79	29	53.8	0.27	
Paradise Valley	79°	40°	59.5°	0.60		Downing	91	41	66.8	1.95		Yellowstone Pk. (Norris)	86	29	55.8	0.92	
Pinehill	105	52	75.9	T.		Eau Claire	93	50	70.6	3.10		Yellowstone Pk. (Riv'side)	85	29	55.9	0.37	
Pomeroy	103	49	76.6	T.		Fond du Lac	92	42	69.0	1.86		Yellowstone Pk. (Snake R.)	93	30	57.2	0.05	
Port Townsend	85	48	63.3	0.35		Grand Rapids	88	43	68.4	2.20		Yellowstone Pk. (Soda R.)	86	25	56.3	1.30	
Pullman	98	46	73.4	0.21		Grand River Locks						Yellowstone Pk. (Thumb)	85	31	55.8	1.13	
Quinault	99	47	67.8	0.55		Grantsburg						Yellowstone Pk. (Up. B.)	81	30	55.5	1.23	
Republic	97	42	70.4	0.07		Hancock	93	45	68.6	2.38		Porto Rico.					
Rox Creek	94°	56°	76.0°	0.06		Harvey	92	47	69.7	1.62		Adjuntas	95	53	73.8	9.85	
Rosalia	97	43	72.6	0.06		Hayward	92	39	65.4	1.53		Aguurre	92	72	80.8	5.93	
Ruby Hill	94	47	71.8	0.26		Hillsboro	91	41	67.8	3.06		Albonita	86	68	76.6	4.00	
Sedro	94	44	66.0	0.51		Koepenick	90	38	65.8	3.20		Anasco	91	65	79.2	9.60	
Sixprong	106	55	82.6	T.		Manitowoc	90	48	66.8	2.89		Arecibo	91	62	77.0	2.55	
Snoqualmie	104	48	70.5	0.34		Mauston	87	43	67.2	2.60		Bayamon	90	67	78.5	8.46	
Southbend	102	48	69.2	0.00		Meadow Valley	90	43	67.6	3.04		Canovanas	89	73	80.7	10.93	
Stehkin	98	59	72.6	0.13		Medford	91	45	68.3	3.90		Cayey	88	66	79.5	8.59	
Sunnyside	101	50	77.0	T.		Menasha						Coloso	90	65	78.5	15.05	
Touchet	109	58	82.0	0.04		Merrill	92	42	67.6	2.35		Corozal	92	53	76.2	5.35	
Union	100	47	68.4	T.		Minocqua	89	52	72.0	2.00		Fajardo	90°	70°	81.2°	8.08	
Vancouver	102	46	72.5	T.		Mount Horeb	91	46	69.6	2.10		Guanaica	95	65	80.0	1.30	
Vashon	86	50	66.6	0.02		Neillsville	94	46	70.0	1.55		Hacienda Josefa				6.75	
Wahluke	108	55	82.8	T.		New London	91	46	69.2	4.18		Humacao	86	70	78.2	10.80	
Waterville	100	49	74.4	0.65		New Richmond	92	46	68.6			Isolina	89	62	75.7	11.97	
Wenatchee (near)	100	56	78.2	0.00		Portage	91	45	68.5	2.15		Juan Diaz	94	69	81.3	6.88	
Wilbur	98	41	70.8	0.40		Port Washington	90	50	68.2	3.05		Lares	92	61	77.2	9.25	
Winthrop	100	47	76.6	0.00		Prairie du Chien	96	68	72.8	3.70		Las Cruces	90	61	73.0	6.18	
Yale	104	45	70.4	0.00		Prontice	88	36	64.6	3.41		Las Marias	90	62	76.4	10.85	
Zindel	110	52	86.6	0.00		Racine	94	52	70.6	1.04		Manati	94	66	80.2	8.29	
West Virginia.						Sheboygan	94	50	69.2	1.75		Mayaguez	93	63	78.6	9.37	
Bancroft	92	55	74.6	7.05		Shullsburg	91	46	68.7	2.28		Morovis	94	60	77.2	6.72	
Bayard	86	45	67.4	2.95		Solon Springs	95	39	68.4	2.22		Rio Blanco	90	67	79.0	18.42	
Beckley	88	57	72.7	4.14		Stanley	89	41	66.6	2.87		Rio Piedras				6.77	
Bene Run	91	55	74.7	3.27		Afton</td											



TABLE III.—Wind resultants, from observations at 8 a. m. and 8 p. m., daily, during the month of July, 1906.

Stations.	Component direction from—				Resultant.		Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.		N.	S.	E.	W.	Direction from—	Duration.
<i>New England.</i>													
Eastport, Me.	6	39	6	17	s. 18 w.	35							
Portland, Me.	13	32	9	22	s. 34 w.	23							
Concord, N. H.†	13	9	6	10	n. 45 w.	6							
Burlington, Vt.†	7	19	3	6	s. 14 w.	12							
Northfield, Vt.	19	33	8	11	s. 12 w.	14							
Boston, Mass.	12	23	20	21	s. 5 w.	11							
Nantucket, Mass.	15	19	17	22	s. 20 w.	15							
Block Island, R. I.	15	31	14	21	s. 24 w.	18							
Providence, R. I.	17	25	15	22	s. 41 w.	11							
Hartford, Conn.	20	32	10	9	s. 5 e.	12							
New Haven, Conn.	18	34	12	10	s. 7 e.	16							
<i>Middle Atlantic States.</i>													
Albany, N. Y.	15	36	13	19	s. 8 e.	21							
Binghamton, N. Y.†	9	5	13	10	n. 37 e.	5							
New York, N. Y.	15	27	20	11	s. 37 e.	15							
Harrisburg, Pa.	15	21	23	16	s. 49 e.	9							
Philadelphia, Pa.	14	31	17	16	s. 3 e.	17							
Soratton, Pa.	20	21	16	19	s. 72 w.	3							
Atlantic City, N. J.	16	27	17	19	s. 10 w.	11							
Cape May, N. J.	15	29	19	12	s. 27 e.	16							
Baltimore, Md.	13	24	18	22	s. 26 w.	12							
Washington, D. C.	19	29	19	9	s. 45 e.	14							
Cape Henry, Va. *	6	19	9	2	s. 28 e.	15							
Lynchburg, Va.	16	23	22	20	s. 16 e.	7							
Mount Weather, Va.	17	24	19	21	s. 16 w.	7							
Norfolk, Va.	13	30	20	15	s. 16 e.	18							
Richmond, Va.	18	30	17	4	s. 47 e.	18							
Wytheville, Va.	9	14	20	30	s. 63 w.	11							
<i>South Atlantic States.</i>													
Asheville, N. C.	19	27	22	10	s. 56 e.	14							
Charlotte, N. C.	14	25	22	15	s. 32 e.	13							
Hatteras, N. C.	13	35	11	23	s. 31 w.	23							
Raleigh, N. C.	15	28	15	18	s. 13 w.	13							
Wilmington, N. C.	10	33	15	25	s. 23 w.	25							
Charleston, S. C.	6	38	13	14	s. 2 w.	32							
Columbia, S. C.	15	23	18	19	s. 7 w.	8							
Augusta, Ga.	11	32	15	15	s. 21	21							
Savannah, Ga.	9	33	11	27	s. 34 w.	29							
Jacksonville, Fla.	4	39	15	17	s. 3 w.	35							
<i>Florida Peninsula.</i>													
Jupiter, Fla.	4	35	10	29	s. 31 w.	36							
Key West, Fla.	6	29	41	7	s. 68 e.	37							
Tampa, Fla.	9	26	25	14	s. 33 e.	20							
<i>Eastern Gulf States.</i>													
Atlanta, Ga.	17	20	23	18	s. 59 e.	6							
Macon, Ga.†	6	16	9	10	s. 6 w.	10							
Thomasville, Ga.	5	36	15	19	s. 7 w.	31							
Pensacola, Fla.†	18	5	5	11	n. 25 w.	14							
Anniston, Ala.	20	27	21	7	s. 63 e.	16							
Birmingham, Ala.†	9	13	9	11	s. 27 w.	4							
Mobile, Ala.	19	23	8	25	s. 77 w.	18							
Montgomery, Ala.	14	25	14	20	s. 29 w.	12							
Meridian, Miss.	19	19	10	30	w.	20							
Vicksburg, Miss.	23	25	7	16	s. 77 w.	9							
New Orleans, La.	8	26	7	33	s. 55 w.	32							
<i>Western Gulf States.</i>													
Shreveport, La.	24	18	17	19	n. 18 w.	6							
Bentonville, Ark.†	8	16	11	5	s. 37 e.	10							
Fort Smith, Ark.	20	13	28	12	n. 66 e.	18							
Little Rock, Ark.	27	15	12	23	n. 43 w.	16							
Corpus Christi, Tex.	2	42	31	2	s. 36 e.	49							
Fort Worth, Tex.	15	21	21	19	s. 18 e.	6							
Galveston, Tex.	11	39	12	16	s. 8 w.	28							
Palestine, Tex.	19	24	19	14	s. 45 e.	7							
San Antonio, Tex.	12	23	37	5	s. 71 e.	34							
Taylor, Tex.†	9	16	3	5	s. 16 w.	7							
<i>Ohio Valley and Tennessee.</i>													
Chattanooga, Tenn.	22	15	14	23	n. 52 w.	11							
Knoxville, Tenn.	21	16	10	28	n. 74 w.	19							
Memphis, Tenn.	24	17	14	18	n. 30 w.	8							
Nashville, Tenn.	14	21	18	23	s. 36 w.	9							
Lexington, Ky.†	8	15	9	9	s.	7							
Louisville, Ky.	18	27	13	19	s. 34 w.	11							
Evansville, Ind.†	12	6	12	7	n. 40 e.	8							
Indianapolis, Ind.	24	19	11	21	n. 63 w.	11							
Cincinnati, Ohio.	16	19	23	21	s. 34 e.	4							
Columbus, Ohio.	18	22	20	15	s. 51 e.	6							
Pittsburg, Pa.	20	29	17	23	w.	6							
Parkersburg, W. Va.	12	31	14	15	s. 3 w.	19							
Elkins, W. Va.	13	27	12	23	s. 38 w.	18							
<i>Lower Lake Region.</i>													
Buffalo, N. Y.	11	30	18	18	s.	19							
Oswego, N. Y.	14	31	15	13	s. 7 e.	17							
Rochester, N. Y.	17	23	14	25	s. 61 w.	12							
Syracuse, N. Y.	14	27	13	18	s. 21 w.	14							
Erie, Pa.	14	21	14	23	s. 52 w.	11							
Cleveland, Ohio.	21	19	19	15	n. 63 e.	4							
Sandusky, Ohio.†	4	12	6	15	s. 48 w.	12							
Toledo, Ohio.	21	13	21	20	n. 7 e.	8							
Detroit, Mich.	21	15	22	19	n. 27 e.	7							
<i>Upper Lake Region.</i>													
Alpena, Mich.	18	22	18	18	s.	4							
Escanaba, Mich.	25	22	11	17	n. 63 w.	7							
Grand Haven, Mich.	17	18	18	23	s. 79 w.	5							
Grand Rapids, Mich.	19	12	20	22	n. 16 w.	7							
Houghton, Mich.†	7	2	15	13	n. 22 e.	5							
Marquette, Mich.	27	11	10	27	n. 47 w.	23							
Port Huron, Mich.	25	19	19	15	n. 34 e.	7							
Sault Ste. Marie, Mich.	15	14	18	30	s. 85 w.	12							
Chicago, Ill.	22	12	20	17	n. 17 e.	10							
Milwaukee, Wis.	24	14	14	18	n. 22 w.	11							
Green Bay, Wis.	20	23	18										

TABLE IV.—Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour, during July, 1906, at all stations furnished with self-registering gages.

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive begin.	Depths of precipitation (in inches) during periods of time indicated.														
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.	
Abilene, Tex.	1	2	3	4	5	6	7	0.00	0.23	0.44	0.54	0.59	0.02	0.14	0.30	0.54	0.75	0.92	1.02	1.09	1.18	
Do	8	2:40 p. m.	3:00 p. m.	0.59	2:40 p. m.	3:00 p. m.	0.00	0.02	0.14	0.30	0.54	0.75	0.92	1.02	1.09	0.89	0.97	1.18				
Albany, N. Y.	11-12	5:40 p. m.	5:55 a. m.	1.20	5:42 p. m.	6:17 p. m.	0.02	0.14	0.30	0.54	0.75	0.92	1.02	1.09	0.89	0.97	1.18					
Do	17	1:15 p. m.	3:20 p. m.	1.28	1:15 p. m.	2:15 p. m.	0.00	0.11	0.28	0.44	0.60	0.69	0.72	0.76	0.81	0.89	0.97	1.18				
Alpena, Mich.	21	10:25 a. m.	11:28 a. m.	0.63	10:38 a. m.	10:58 a. m.	T	0.10	0.25	0.42	0.61											
Alpena, Mich.	15	12:53 p. m.	6:15 p. m.	1.94	12:53 p. m.	1:50 p. m.	0.00	0.50	0.73	0.92	0.94	1.01	1.17	1.29	1.51	1.60	1.70	1.85				
Amarillo, Tex.	8			0.50																		
Asheville, N. C.	22	2:50 p. m.	3:10 p. m.	0.59	2:59 p. m.	3:08 p. m.	0.03	0.33	0.56													
Atlanta, Ga.	2	2:45 p. m.	4:25 p. m.	1.17	2:55 p. m.	3:25 p. m.	0.07	0.20	0.35	0.52	0.67	0.78	0.85									
Do	17	11:40 a. m.	12:37 p. m.	1.35	11:40 a. m.	12:30 p. m.	T	0.21	0.54	0.77	0.90	1.05	1.14	1.18	1.19	1.22	1.34					
Atlantic City, N. J.	3	4:05 p. m.	6:45 p. m.	1.18	4:32 p. m.	5:07 p. m.	0.02	0.09	0.52	0.63	0.70	0.85	1.08	1.16								
Do	24	D. N.	1:30 p. m.	2.17	4:37 a. m.	6:05 a. m.	0.04	0.18	0.35	0.42	0.50	0.60	0.66	0.67	0.68	0.80	0.96	1.00	1.33	1.47		
Augusta, Ga.	6	2:02 p. m.	4:50 p. m.	1.77	2:18 p. m.	3:28 p. m.	0.04	0.08	0.26	0.49	0.80	1.03	1.33	1.45	1.55							
Do	14	10:07 a. m.	2:40 p. m.	3.66	12:33 p. m.	2:11 p. m.	0.10	0.28	0.49	0.49	0.66	0.82	1.07	1.36	1.65	1.69	1.81	2.13	2.70	3.24		
Do	22	12:06 p. m.	2:10 p. m.	2.63	12:21 p. m.	1:03 p. m.	0.07	0.19	0.36	0.39	0.44	0.59	0.98	1.45	1.71	1.75						
Baltimore, Md.	3	5:55 p. m.	7:25 p. m.	1.09	5:58 p. m.	6:18 p. m.	0.01	0.05	0.52	0.80	0.91											
Do	22-23	1:50 p. m.	1:35 a. m.	4.01	1:58 p. m.	2:48 p. m.	0.01	0.09	0.35	0.47	0.64	0.76	1.00	1.07	1.08	1.08	1.08	2.32	2.61	2.78	2.88	
Binghamton, N. Y.	17	9:55 a. m.	2:00 p. m.	0.99	10:32 a. m.	11:01 a. m.	0.04	0.09	0.18	0.39	0.56	0.67	0.74									
Birmingham, Ala.	14	12:33 p. m.	2:17 p. m.	1.15	1:29 p. m.	2:06 p. m.	0.06	0.10	0.18	0.41	0.59	0.80	0.95	0.97	1.10							
Do	17	2:10 p. m.	3:25 p. m.	0.71	2:40 p. m.	3:05 p. m.	0.07	0.12	0.38	0.55	0.60											
Bismarck, N. Dak.	11			0.41																		
Block Island, R. I.	30	2:30 a. m.	6:15 a. m.	0.98	5:20 a. m.	5:38 a. m.	0.27	0.12	0.40	0.58	0.67											
Boise, Idaho.	6			0.01																		
Boston, Mass.	10	3:37 p. m.	5:50 p. m.	1.12	3:47 p. m.	4:22 p. m.	T	0.07	0.20	0.33	0.61	0.75	0.77	0.96								
Do	30	12:10 a. m.	8:15 a. m.	1.36	2:48 a. m.	3:32 a. m.	0.09	0.05	0.10	0.16	0.24	0.28	0.33	0.49	0.59	0.67						
Buffalo, N. Y.	3-4			1.67																		
Cairo, Ill.	20	3:27 p. m.	6:30 p. m.	0.85	3:44 p. m.	4:01 p. m.	0.02	0.26	0.50	0.64												
Do	23	1:20 p. m.	3:00 p. m.	0.67	1:44 p. m.	2:01 p. m.	0.03	0.07	0.22	0.53	0.60											
Charles City, Iowa.	14	11:20 a. m.	3:22 p. m.	0.96	11:31 a. m.	12:23 p. m.	0.06	0.12	0.24	0.35	0.36	0.36	0.39	0.42	0.53	0.66	0.73	0.76				
Do	27-28	11:15 p. m.	3:45 a. m.	1.70	1:04 a. m.	1:40 a. m.	0.21	0.26	0.36	0.47	0.51	0.53	0.93	1.22	1.25							
Charleston, S. C.	15	D. N.	7:50 a. m.	1.53	7:12 a. m.	7:24 a. m.	1.02	0.13	0.45	0.51												
Do	22-23	9:40 p. m.	D. N.	1.04	1:01 a. m.	1:22 a. m.	0.29	0.08	0.16	0.36	0.65											
Charlotte, N. C.	17	5:15 p. m.	D. N.	1.63	6:41 p. m.	7:58 p. m.	0.03	0.20	0.48	0.54	0.59	0.60	0.60	0.62	0.68	0.81	1.15	1.34				
Do	18-19	11:00 p. m.	D. N.	1.14	11:50 p. m.	12:28 a. m.	0.13	0.16	0.22	0.23	0.30	0.48	0.61	0.82	0.89							
Chattanooga, Tenn.	13-14	5:35 p. m.	11:50 a. m.	4.08	2:45 p. m.	3:35 a. m.	0.56	0.06	0.12	0.16	0.23	0.32	0.44	0.56	0.66	0.78	0.89					
Do	20	2:03 p. m.	4:15 p. m.	0.72	2:31 p. m.	2:51 p. m.	0.01	0.29	0.59	0.64	0.70											
Cheyenne, Wyo.	14	3:15 p. m.	7:40 p. m.	0.86	3:28 p. m.	3:39 p. m.	0.01	0.12	0.31	0.35												
Chicago, Ill.	15	11:15 a. m.	1:00 p. m.	1.34	11:17 a. m.	11:47 a. m.	0.01	0.05	0.22	0.33	0.33	0.39	0.41	0.46	0.51	0.60	0.72	0.80				
Do	28	1:14 a. m.	12:45 p. m.	1.69	11:20 a. m.	12:25 p. m.	0.03	0.08	0.20	0.32	0.38	0.49	0.59	0.60	0.66	0.75	0.81	1.32	1.61			
Cincinnati, Ohio.	22	D. N.	10:05 a. m.	2.16	4:48 a. m.	5:38 a. m.	0.03	0.22	0.44	0.71	1.12	1.41	1.46	1.49	1.52	1.63	1.70					
Cleveland, Ohio.	23	9:30 a. m.	11:29 a. m.	0.92	9:39 a. m.	10:03 a. m.	0.02	0.47	0.65	0.71	0.76	0.82										
Columbus, Mo.	27	1:43 p. m.	2:57 p. m.	0.41	2:24 p. m.	2:31 p. m.	0.01	0.36	0.39													
Columbia, S. C.	22	6:23 p. m.	7:08 p. m.	0.70	6:26 p. m.	6:42 p. m.	0.01	0.14	0.42	0.61												
Do	5	8:06 p. m.	8:55 p. m.	0.62	8:14 p. m.	8:31 p. m.	0.01	0.26	0.41	0.53	0.59											
Cincinnati, Ohio.	22	D. N.	10:05 a. m.	2.16	4:48 a. m.	5:38 a. m.	0.03	0.22	0.44	0.71	1.12	1.41	1.46	1.49	1.52	1.63	1.70					
Do	23	9:30 a. m.	11:29 a. m.	0.92	9:39 a. m.	10:03 a. m.	0.02	0.47	0.65	0.71	0.76	0.82										
Columbus, Ohio.	6	1:36 p. m.	3:25 p. m.	0.67	2:26 p. m.	2:43 p. m.	0.01	0.09	0.13	0.20	0.40	0.61	0.82	0.97								
Columbus, Ohio.	3	5:03 p. m.	6:25 p. m.	0.67	5:29 p. m.	5:49 p. m.	0.06	0.20	0.37	0.46	0.52											
Do	22	11:10 a. m.	2:30 p. m.	0.78	12:20 p. m.																	

TABLE IV.—Accumulated amounts of precipitation for each 5 minutes, etc.—Continued.

TABLE IV.—Accumulated amounts of precipitation for each 5 minutes, etc.—Continued.

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Valentine, Nebr.	1	2	3	4	5	6	7														
Vicksburg, Miss.	11	12:01 p.m.	1:11 p.m.	1.13	12:01 p.m.	12:32 p.m.	0.00	0.11	0.48	0.71	0.83	0.92	1.00	1.05							
Washington, D. C.	23	6:51 p.m.	8:30 p.m.	0.91	6:54 p.m.	7:43 p.m.	0.01	0.19	0.32	0.39	0.41	0.41	0.42	0.44	0.55	0.80	0.85				
Do.	11	2:13 p.m.	3:30 p.m.	1.77	2:14 p.m.	3:00 p.m.	0.01	0.06	0.21	0.60	0.72	0.84	1.04	1.38							
Wichita, Kans.	22	4:20 p.m.	11:53 p.m.	2.40	8:31 p.m.	8:55 p.m.	1.07	0.18	0.32	0.52	0.63										
Do.	1	2:00 a.m.	5:35 a.m.	1.26	2:02 a.m.	2:36 a.m.	0.01	0.12	0.26	0.44	0.58	0.73	0.91	1.00							
Wilmington, N. C.	31	6:20 p.m.	9:00 p.m.	0.88	6:28 p.m.	6:47 p.m.	0.04	0.10	0.30	0.52	0.60										
Wytheville, Va.	23-24	8:10 p.m.	D. N.	1.21	12:26 a.m.	12:51 a.m.	0.31	0.16	0.29	0.40	0.55	0.63									
Do.	19	1:40 p.m.	3:15 p.m.	0.67	2:34 p.m.	2:50 p.m.	0.03	0.13	0.35	0.49	0.60										
Do.	22	2:41 p.m.	3:22 p.m.	0.53	2:44 p.m.	3:03 p.m.	0.01	0.05	0.21	0.41	0.47										
Yankton, S. Dak.	29	2:03 a.m.	4:29 p.m.	1.36	11:42 a.m.	12:04 p.m.	0.37	0.12	0.45	0.60	0.80	0.86									
San Juan, Porto Rico	7-8	2:22 p.m.	12:30 p.m.	1.85	2:35 p.m.	2:52 p.m.	0.01	0.15	0.36	0.52											
Do.	7-8	2:22 p.m.	12:30 p.m.	1.85	7:19 a.m.	7:35 a.m.	1.19	0.19	0.40	0.48											
Do.	16-17	D. N.	9:20 a.m.	1.46	11:44 p.m.	11:53 p.m.	0.01	0.19	0.34												

\* Self-register not working

TABLE V.—Data furnished by the Canadian Meteorological Service, July, 1906.

Stations.	Pressure, in inches.				Temperature.				Precipitation.				Stations.	Pressure, in inches.				Temperature.				Precipitation.			
	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Total snowfall.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Total snowfall.					
St. Johns, N. F.	Ins.	Ins.	Ins.	o	o	o	o	Ins.	Ins.	Ins.	Ins.	Ins.	Parry Sound, Ont.	Ins.	Ins.	o	o	o	o	o	o	o	o		
Sydney, C. B. I.	29.83	29.96	-0.01	63.9	+ 4.6	72.8	55.0	1.31			29.28	29.96	0.0	68.5	+ 2.5	79.2	57.8	3.10	+ 0.48						
Halifax, N. S.	29.93	29.97	+ 0.04	66.2	+ 3.9	76.3	56.1	5.64	+ 1.99		29.25	29.96	+ 0.2	62.1	+ 0.1	71.7	52.5	3.30	+ 0.12						
Grand Manan, N. B.	29.90	30.00	+ 0.04	65.3	+ 1.9	73.7	56.8	6.12	+ 2.07		29.12	29.93	+ 0.0	66.9	+ 0.9	77.5	56.3	3.37	+ 0.29						
Yarmouth, N. S.	29.94	30.01	+ 0.02	61.8	+ 0.1	69.8	53.9	2.17	- 0.83		28.16	29.94	+ 0.1	65.9	+ 3.7	77.4	54.5	2.58	- 0.02						
Charlottetown, P. E. I.	29.91	29.95	+ 0.03	68.0	+ 3.9	75.5	60.4	1.87	- 1.62		27.73	29.93	+ 0.1	66.6	+ 3.1	79.2	54.1	1.80	- 0.68						
Chatham, N. B.	29.88	29.90	+ 0.02	69.6	+ 4.6	81.3	57.8	2.10	- 2.09		27.47	29.99	+ 0.8	68.0	+ 1.5	82.0	53.9	0.30	- 2.14						
Father Point, Que.	29.86	29.88	+ 0.03	59.9	+ 2.3	68.9	51.0	0.68	- 2.36		26.50	29.97	+ 0.7	64.2	+ 3.6	79.2	49.3	1.15	- 1.53						
Quebec, Que.	29.61	29.93	+ 0.02	68.6	+ 3.1	80.0	57.2	2.87	- 1.39		25.48	29.98	+ 0.8	68.8	+ 7.2	79.9	45.7	0.89	- 2.35						
Montreal, Que.	29.73	29.93	.00	70.6	+ 2.1	79.3	61.9	2.37	- 1.92		27.68	29.92	+ 0.2	66.4	+ 5.8	78.8	53.9	3.60	+ 0.57						
Rockcliffe, Ont.	29.34	29.94	.00	67.4	+ 1.8	81.7	53.2	0.72	- 2.40		28.36	29.89	+ 0.2	64.5	+ 2.6	75.9	53.2	1.78	- 0.27						
Ottawa, Ont.	29.60	29.92	- 0.02	70.5	+ 1.0	81.0	60.0	1.72	- 1.75		28.26	29.97	+ 0.7	67.4	+ 2.7	80.8	53.9	1.68	- 0.66						
Kingston, Ont.	29.64	29.94	- 0.03	67.9	- 0.3	75.2	60.6	1.74	- 1.15																
Toronto, Ont.	29.58	29.94	- 0.03	70.1	+ 2.1	79.9	60.3	3.41	+ 0.49																
White River, Ont.	28.61	29.90	- 0.04	60.8	+ 1.3	76.4	45.2	0.50	- 2.30																
Port Stanley, Ont.	29.33	29.96	- 0.02	68.6	+ 0.8	77.9	59.2	2.91	- 0.13																
Saugeen, Ont.	29.29	29.99	+ 0.02	66.6	+ 1.9	75.5	57.8	1.17	- 0.81																

TABLE VI.—Heights of rivers referred to zeros of gages, July, 1906.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.		
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.				
Milk River.	Miles.	9	4.6	1	2.7	29-31	3.4	1.9	Missouri River—Cont'd.	Miles.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.		
Havre, Mont.	237	8	4.8	6-9	2.4	31	3.9	2.4	Glasgow, Mo.	231	18	13.3	2	8.0	31	10.3	5.3		
Yellowstone River.	330	8	4.8	6-9	2.4	31	3.9	2.4	Boonville, Mo.	199	20	14.9	1.2	9.9	29,30	11.9	5.0		
Billings, Mont.	330	14	1.2	19-25,31	0.6	1,11-14	1.0	0.6	Hermann, Mo.	103	24	15.4	2	9.8	31	12.0	5.6		
James River.	Lamoure, N. Dak.	14	1.2	19-25,31	0.6	1,11-14	1.0	0.6	Minnedosa, Man.	28.16	24	19.94	+ 0.1	65.9	+ 3.7	77.4	54.5	2.58	- 0.02
Huron, S. Dak.	330	9	3.8	1	0.9	30,31	2.1	2.9	Qu'Appelle, Sask.	27.73	29.93	+ 0.1	66.6	+ 3.1	79.2	54.1	1.80	- 0.68	
Big Blue River.	139	14	5.0	5	2.3	10-14	3.1	2.7	Medicine Hat, Alberta.	27.68	29.90	+ 0.0	60.0	+ 0.0	79.2</				

TABLE VI.—Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
<i>Monongahela River—Cont'd.</i>									<i>Arkansas River—Cont'd.</i>								
Fairmont, W. Va.	119	25	14.9	23, 25	14.1	15	14.5	0.8	Fort Smith, Ark.	403	22	10.2	26	5.5	9	7.3	4.7
Greensburg, Pa.	81	18	7.6	1, 24, 25	6.5	12-19	7.0	1.1	Dardanelle, Ark.	256	21	9.5	25	4.2	9, 11	6.6	5.3
Lock No. 4, Pa.	40	28	9.3	25	5.5	4-7	8.1	2.8	Little Rock, Ark.	176	23	10.5	29	6.1	12	7.9	4.4
<i>Beaver River.</i>									Pine Bluff, Ark.	121	23	13.0	30	7.9	1	10.1	5.1
Ellwood Junction, Pa.	10	14	4.0	30	1.9	17	2.9	2.1	<i>Yazoo River.</i>								
<i>Muskingum River.</i>									Greenwood, Miss.	175	38	9.9	31	2.7	8	5.9	7.2
Zanesville, Ohio	70	25	9.8	20, 22	7.9	15	8.5	1.9	Yazoo City, Miss.	80	25	7.0	30	0.1	5, 12	2.2	6.9
Beverly, Ohio.	20	25	7.5	23	4.4	4	5.5	3.1	<i>Osawitcha River.</i>								
<i>Little Kanawha River.</i>									Camden, Ark.	304	39	19.8	31	3.3	10, 11	8.2	16.5
Glenville, W. Va.	77	20	3.0	17, 23	0.0	13	1.5	3.0	Monroe, La.	122	40	9.6	30	2.5	13	5.9	7.1
<i>New-Great Kanawha River.</i>									Arthur City, Tex.	688	27	14.6	30	7.3	9	9.9	7.3
Radford, Va.	213	14	3.6	31	0.4	17	1.7	3.2	Fulton, Ark.	515	28	17.8	31	9.7	11, 12	12.2	8.1
Hinton, W. Va.	153	14	3.2	31	1.6	3-5, 14-16	2.2	1.6	Shreveport, La.	327	29	7.7	19	2.4	15	4.4	5.3
Charleston, W. Va.	58	30	7.6	17-19	6.4	5	7.0	1.2	Alexandria, La.	118	33	9.5	23, 24	5.0	12	7.1	4.5
<i>Scioto River.</i>									<i>Mississippi River.</i>								
Columbus, Ohio	110	17	5.0	24	1.0	2, 3	2.9	4.0	Fort Ripley, Minn.	2,082	10	9.0	3	5.8	30, 31	7.1	3.2
<i>Licking River.</i>									St. Paul, Minn.	1,954	14	10.6	6	5.9	27	8.2	4.7
Falmouth, Ky.	30	25	5.5	24	1.0	16	2.4	4.5	Red Wing, Minn.	1,914	14	8.2	2, 4, 5	4.0	30, 31	6.2	4.2
<i>Miami River.</i>									Reeds Landing, Minn.	1,884	12	7.2	1, 4	3.6	31	5.6	3.6
Dayton, Ohio	77	18	3.0	8	0.9	6	1.5	2.1	La Crosse, Wis.	1,819	12	8.6	3-6	5.1	31	7.2	3.5
<i>Kentucky River.</i>									Prairie du Chien, Wis.	1,759	18	9.9	5-9	5.8	31	8.4	4.1
Jackson, Ky.	287	24	6.0	19, 23, 24	4.4	3	5.0	1.6	Dubuque, Iowa	1,699	18	10.9	1	6.4	31	9.2	4.5
Beattyville, Ky.	254	30	2.5	24	0.1	11-20	4.0	2.4	Clinton, Iowa	1,629	16	10.7	1	6.2	31	8.6	4.5
High Bridge, Ky.	117	17	11.0	25, 26	9.3	6, 7, 11	9.7	1.7	LeClaire, Iowa	1,609	10	7.0	1, 2	4.3	31	5.6	2.7
Frankfort, Ky.	65	31	7.2	26	5.8	5, 6, 10	6.2	1.4	Davenport, Iowa	1,593	15	9.6	1	5.6	31	7.6	4.0
<i>Wabash River.</i>									Muscatine, Iowa	1,562	16	11.2	1	6.7	29-31	8.8	4.5
Mount Carmel, Ill.	75	15	2.3	1	1.0	21	1.5	1.3	Gallatin, Iowa	1,472	8	5.6	2, 3	3.0	31	4.3	2.6
<i>Ohio River.</i>									Keokuk, Iowa	1,463	15	9.8	2	5.2	31	7.5	4.5
Burnside, Ky.	518	50	15.2	24	1.3	7, 8	5.0	13.9	Warsaw, Ill.	1,458	12	12.6	2, 3	8.0	31	10.3	4.6
Celina, Tenn.	323	45	15.8	26	1.5	7, 8	5.5	14.3	Hannibal, Mo.	1,402	13	10.7	3, 4	6.0	31	8.5	4.7
Carthage, Tenn.	308	40	12.9	26	1.4	10	5.1	11.5	Grafton, Ill.	1,306	23	11.9	5	7.8	31	9.9	4.1
Nashville, Tenn.	193	40	16.2	28	7.8	7, 11, 12, 15	10.3	8.4	St. Louis, Mo.	1,264	30	20.4	3	11.2	31	15.8	9.2
Clarksville, Tenn.	126	42	17.1	30	2.0	13	7.3	15.1	Luxor, Ark.	905	33	11.4	1	8.0	16, 17	9.6	3.4
<i>Powell River.</i>									Memphis, Tenn.	843	33	15.3	1	11.7	20, 21	13.5	3.6
Tazewell, Tenn.	44	20	2.2	31	0.3	6, 7, 11-16	0.8	1.9	Helena, Ark.	767	42	21.6	1	16.3	21, 22	18.6	5.3
<i>Cinch River.</i>									Arkansas City, Ark.	635	42	23.3	1	19.9	22, 22	5.4	
Speers Ferry, Va.	156	20	4.9	31	— 0.7	16	0.7	5.6	Greenville, Miss.	595	42	20.6	1	16.1	22-24	18.0	4.5
Clinton, Tenn.	52	25	9.2	31	3.0	16, 17	5.3	6.2	Vicksburg, Miss.	474	45	22.6	2, 3	17.4	25	19.7	5.2
<i>South Fork Holston River.</i>									Natchez, Miss.	373	46	24.1	3	19.0	25-27	21.4	5.1
Bluff City, Tenn.	35	12	3.0	30, 31	0.4	14, 15	1.1	2.6	Baton Rouge, La.	240	35	15.0	1	9.0	25-27	12.1	6.0
<i>Holston River.</i>									Donaldsonville, La.	188	28	10.8	1	6.6	25-27	8.4	4.2
Mendota, Va.	165	8	9.9	30	0.5	3, 4	1.3	9.4	New Orleans, La.	108	16	7.4	1	5.0	26	6.1	2.4
Rogersville, Tenn.	103	14	6.2	31	1.7	3, 4, 13-16	2.4	4.5	<i>Atchafalaya River.</i>								
<i>French Broad River.</i>									Simmesport, La.	127	33	18.8	1	14.8	28, 29	16.3	4.0
Asheville, N. C.	144	4	2.9	19	0.2	12-14	1.1	2.7	Meville, La.	163	31	22.0	1	18.5	28-30	19.9	3.5
Leadale, Tenn.	70	12	3.0	16, 18	0.8	7	1.7	2.2	Morgan City, La.	19	8	4.5	4	3.0	25	3.9	1.5
Dandridge, Tenn.	46	12	4.2	18	1.2	14	2.2	3.0	<i>Grand River.</i>								
<i>Little Tennessee River.</i>									Grand Rapids, Mich.	38	11	1.7	31	1.2	15, 21-28	1.4	0.5
McGhee, Tenn.	17	20	9.3	18	3.5	3	5.3	5.8	Tiffin, Ohio.	65	8	1.0	29	— 0.3	3, 4	0.2	1.3
<i>Hiccupes River.</i>									Hartford, Conn.	50	16	7.1	4	2.6	16, 18, 22	3.7	4.5
Charleston, Tenn.	18	22	14.9	15	1.5	7	4.7	13.4	<i>Mohawk River.</i>								
<i>Tennessee River.</i>									Utica, N. Y.	98	6	5.2	10, 11	0.1	22, 25, 28, 30	1.5	5.1
Knoxville, Tenn.	635	12	6.5	18	1.4	14	3.1	5.1	Tribe Hill, N. Y.	42	12	2.0	2	— 0.2	20-28	0.4	2.2
Loudon, Tenn.	590	25	8.5	18	2.0	3	4.0	6.5	Schenectady, N. Y.	19	15	3.2	4	0.4	28	1.3	2.8
Kingston, Tenn.	556	25	8.3	23	2.0	4	4.2	6.3	<i>Hudson River.</i>								
Chattanooga, Tenn.	452	33	15.0	20	3.5	5, 6	7.3	11.5	Troy, N. Y.	154	14	3.9	2, 5, 7	2.9	10, 11, 18, 19	3.3	1.0
Bridgeport, Ala.	402	24	11.8	20	2.0	6	5.5	9.8	Albany, N. Y.	147	12	5.5	9	1.8	15, 30	3.6	3.7
Guntersville, Ala.	349	31	18.0	21	4.2	7	9.3	13.8	<i>Pasquotank River.</i>								
Florence, Ala.	255	16	10.5	24	1.8	8, 9, 11	5.3	8.7	Simmesport, La.	127	33	18.8	1	14.8	28, 29	16.3	4.0
Bervertown, Ala.	225	26	16.6	22	3.7	9	8.8	12.9	Meville, La.	163	31	22.0					

TABLE VI.—Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.			
<i>Tar River.</i>	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>		<i>Alabama River.</i>	<i>Miles.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>	
Tarboro, N. C.	46	25	6.4	18, 19	1.6	4	3.6	4.8	Montgomery, Ala.	323	35	23.8	21	2.8	3	10.7	21.0	
Greenville, N. C.	21	22	8.5	25	3.3	4	5.3	5.2	Selma, Ala.	246	35	25.6	22	3.3	4	12.5	22.8	
<i>Haw River.</i>									<i>Black Warrior River.</i>									
Moncure, N. C.	171	25	14.7	23	8.2	1	9.2	6.5	Tuscaloosa, Ala.	90	43	26.8	19	4.8	7, 9	11.2	22.0	
<i>Cape Fear River.</i>									<i>Lumber River.</i>									
Fayetteville, N. C.	112	38	27.7	24	3.9	3	10.0	23.8	Columbus, Miss.	316	33	4.0	19	— 3.0	1, 9-13	— 1.3	7.0	
<i>Waccamaw River.</i>									Vienna, Ala.	246	42	8.2	20	0.7	13	2.7	7.5	
Conway, S. C.	40	7	5.8	31	2.5	18	3.8	3.3	Demopolis, Ala.	168	35	21.3	21	— 1.8	11	6.8	23.1	
<i>Pedee River.</i>									<i>Pascagoula River.</i>									
Cheraw, S. C.	149	27	19.2	24	2.9	18	8.0	16.3	Merrill, Miss.	78	20	8.6	24, 25	2.2	8	5.4	6.4	
Smiths Mills, S. C.	51	16	13.5	31	8.0	23	10.5	5.5	<i>Pearl River.</i>									
<i>Lynch Creek.</i>									Columbia, Miss.	110	14	7.2	21	3.6	7-9	4.3	3.6	
Effingham, S. C.	35	12	9.4	26	5.3	8, 4	7.2	4.1	Logansport, La.	315	25	16.0	31	4.2	11	6.8	11.8	
<i>Black River.</i>									<i>Neches River.</i>									
Kingstree, S. C.	45	12	9.9	31	6.0	14-16	7.4	3.9	Rockland, Tex.	105	20	8.8	29	1.4	11	3.6	7.4	
<i>Catawba-Wateree River.</i>									Beaumont, Tex.	18	10	1.6	2, 20, 30	1.0	8	1.4	0.6	
Mount Holly, N. C.	143	15	3.6	16	1.6	3-6	2.5	2.0	<i>Trinity River.</i>									
Catawba, S. C.	107	11	6.4	23	1.9	15	3.7	4.5	Dallas, Tex.	320	25	26.4	31	4.7	6-9	11.5	21.7	
Camden, S. C.	54	24	18.1	29	5.1	16	11.4	13.0	Long Lake, Tex.	211	35	19.8	24	4.8	11	11.4	15.0	
<i>Broad River.</i>									Riverside, Tex.	112	40	9.8	26	2.2	11	5.9	7.6	
Blairs, S. C.	36	14	5.6	26	0.7	17	2.6	4.9	Liberty, Tex.	20	25	11.5	29	6.5	12	9.0	5.0	
Pelzer, S. C.	109	7	5.2	18, 20	3.0	14	4.1	2.2	<i>Brazos River.</i>									
Chappells, S. C.	56	14	11.1	9	2.4	1	6.4	8.7	Kopperl, Tex.	345	21	4.0	22	0.8	10, 11	1.9	3.2	
<i>Oconee River.</i>									Waco, Tex.	285	24	10.4	23	3.2	11	5.6	7.2	
Columbia, S. C.	52	15	5.9	20	1.3	8	2.8	4.6	Valley Junction, Tex.	215	40	10.9	21	3.4	8	6.6	7.5	
<i>Santee River.</i>									Hempstead, Tex.	140	40	13.6	23	4.2	5	7.3	9.4	
Rimini, S. C.	108	10	13.0	29	7.0	17	11.1	6.0	Booth, Tex.	61	39	8.7	18	4.2	28-31	6.0	4.5	
St. Stephens, S. C.	50	10	8.8	31	7.5	19, 20	8.1	1.3	<i>Colorado River.</i>	489	21	9.0	16	1.8	1-8, 15, 21-23, 25-31	2.4	7.2	
<i>Edisto River.</i>									Austin, Tex.	214	18	5.8	19, 20, 22	2.5	3	4.4	3.3	
Edisto, S. C.	75	6	5.2	10	3.6	17	4.3	1.6	Columbus, Tex.	98	24	15.2	18	7.2	12-14	9.6	8.0	
<i>Broad River.</i>									<i>Guadalupe River.</i>									
Carlton, Ga.	30	11	7.9	17	2.4	1, 2	4.3	5.5	Gonzales, Tex.	112	22	2.4	18	0.2	1-6	0.5	2.2	
<i>Savannah River.</i>									Victoria, Tex.	35	16	3.3	20	0.9	16	1.5	2.4	
Calhoun Falls, S. C.	347	15	9.0	9, 16	2.9	1	4.8	6.1	<i>Rio Grande River.</i>									
Augusta, Ga.	268	32	21.1	17	7.6	1	13.3	13.5	San Marcial, N. Mex.	1,233	14	8.9	20	7.9	2, 28, 29	8.3	1.0	
<i>Oconee River.</i>									El Paso, Tex.	1,030	14	8.8	19	7.2	31	8.2	1.6	
Milledgeville, Ga.	147	25	12.0	19	3.1	7	6.2	8.9	<i>Red River of the North.</i>									
Dublin, Ga.	79	30	10.2	23	0.9	2, 3	5.5	9.3	Moorhead, Minn.	284	26	12.7	5-7	10.9	26-31	11.7	1.8	
<i>Ocmulgee River.</i>									<i>Kootenai River.</i>									
Macon, Ga.	203	18	10.5	20	2.3	8	5.2	8.2	Bonner Ferry, Idaho.	123	24	15.4	1	7.9	31	12.4	7.5	
Abbeville, Ga.	96	11	8.7	30	2.8	10	5.4	5.9	<i>Pend d'Orille River.</i>									
<i>Flint River.</i>									Newport, Wash.	86	14	6.2	1-3	2.3	31	4.5	3.9	
Woodbury, Ga.	227	10	3.6	12	0.2	1	1.5	3.4	<i>Snake River.</i>									
Montezuma, Ga.	152	20	10.0	26	3.0	1, 2	6.1	7.0	Lewiston, Idaho.	144	24	7.6	1	2.0	26-31	4.0	5.6	
Albany, Ga.	90	20	8.4	19	1.9	2	5.5	6.5	Riparia, Wash.	67	30	7.5	1	2.2	31	4.5	5.3	
Bainbridge, Ga.	29	22	11.6	20	5.7	4	8.5	5.9	<i>Columbia River.</i>									
<i>Chattohoochee River.</i>									Wenatchee, Wash.	473	40	27.0	14-16	22.3	31	24.6	4.7	
Oakdale, Ga.	305	18	12.5	19	2.0	5	5.8	10.5	Umatilla, Oreg.	270	25	12.5	14	9.9	31	11.6	2.6	
West Point, Ga.	239	20	8.6	20	2.5	1, 3	4.9	6.1	The Dalles, Oreg.	166	40	19.1	15	14.4	31	17.7	4.7	
Eufaula, Ala.	90	40	14.0	21	2.2	3	7.0	11.8	<i>Willamette River.</i>									
Alaga, Ala.	30	25	16.3	17	4.0	8	10.2	12.3	Albany, Oreg.	118	20	8.0	1	1.4	28-31	1.9	1.6	
<i>Coosa River.</i>									Salem, Oreg.	84	20	1.7	1	0.0	28-31	0.5	1.7	
Rome, Ga.	266	30	16.7	19	2.0	12-14	5.6	14.7	Portland, Oreg.	12	15	10.3	6, 7	7.5	31	9.4	2.8	
Gadsden, Ala.	162	22	17.9	20	2.0	14	7.0	15.9	<i>Sacramento River.</i>									
Lock No. 4, Ala.	113	17	14.9	19	1.7	3, 4	6.1	13.2	Red Bluff, Cal.	201	23	3.3	6	1.4	30, 31	2.2	1.9	
Wetumpka, Ala.	12	45	27.0	21	5.0	3, 7	13.4	22.0	Sacramento, Cal.	64	25	20.5	1, 2	11.7	31	16.3	8.8	
<i>Tallapoosa River.</i>																		
Milstead, Ala.	42	35	18.5	16	2.0	2	7.3	16.5										

(a) 1 day missing.

## CLIMATOLOGICAL DATA FOR COSTA RICA.

Communicated by Señor Anastasio Alfaro, director of the Physico-Geographic Institute of San José.

APRIL, 1906.

SAN JOSE.

[Altitude, 8835 feet.  $\phi = 9^{\circ} 56' 13''$  N.  $\lambda = 84^{\circ} 4' 10.75''$  W. of Greenwich.]
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